



CORRECTIVE MEASURES STUDY WORK PLAN

Prepared For:

REFINED METALS CORPORATION
Beech Grove, Indiana
EPA ID ID000718130

Prepared By:

ADVANCED GEOSERVICES CORP.
Chadds Ford, Pennsylvania

US EPA RECORDS CENTER REGION 5



1003155

Project No. 2003-1046-04
April 21, 2003
Revised July 11, 2003



Matthew A. Love
Director, Environmental Affairs
Exide Technologies
3000 Montrose Ave.
Reading, PA 19605
610.921.4054 tel
610.921.4062
fax

July 11, 2003

United States Environmental
Protection Agency - Region V
RCRA Enforcement Branch
77 W. Jackson Street, HRE-8J
Chicago, IL 60604-3590
Attn: Mr. Jonathan Adenuga

Re: Revised Corrective Measures Work Plan
Refined Metals Corporation
Beech Grove, Indiana

Dear Mr. Adenuga,

Please find enclosed a revised Corrective Measures Work Plan (Revision 1.0) for the subject facility. This revision reflects EPA comments issued on June 4, 2003 regarding the original version of the Work Plan. I certify under penalty of perjury that the information contained in or accompanying the revised Corrective Measures Work Plan is, to the best of my knowledge after thorough investigation, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Sincerely,

EXIDE TECHNOLOGIES

A handwritten signature in black ink, appearing to read "Matt Love", written over the printed name.

Matthew A. Love
Director, Environmental Affairs

Enclosure

cc: Rebecca Joniskan - IDEM (w. encl.)



CORRECTIVE MEASURES STUDY WORK PLAN

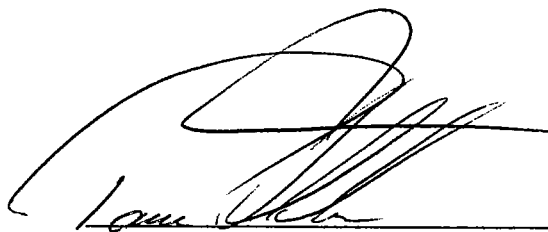
Prepared For:

REFINED METALS CORPORATION
Beech Grove, Indiana
EPA ID ID000718130

Prepared By:

ADVANCED GEOSERVICES CORP.
Chadds Ford, Pennsylvania

Project No. 2003-1046-04
April 21, 2003
Revised July 11, 2003



Paul G. Stratman, P.E.
Registration No. PE 9400366

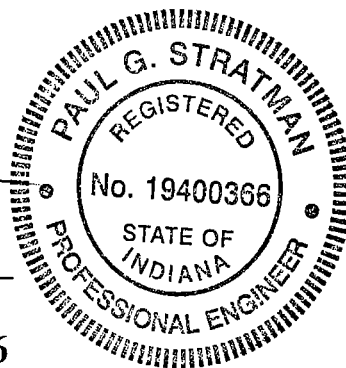




TABLE OF CONTENTS

PAGE NO.

1.0 Introduction	1-1
1.1 Purpose	1-1
1.2 Organization	1-1
2.0 Identification and Development of the Corrective Measures Alternatives	2-1
2.1 Description of Current Situation	2-1
2.2 Establishment of Corrective Action Objectives	2-4
2.3 Phase I Corrective Measure Study Activities	2-5
2.4 Exposure Pathways and Receptors	2-8
2.4.1 Facility Area	2-8
2.4.2 Grassy Areas North and South of Main Gate	2-8
2.4.3 Offsite Natural Gas Facility	2-9
2.5 Identification of Chemicals of Potential Concern (COPCs)	2-9
2.6 Exposure Assessment	2-9
2.7 Risk Characterization	2-10
2.8 Lead Risk Characterization	2-10
2.9 Uncertainty Analysis	2-11
2.10 Identification of the Corrective Measure Alternatives	2-11
2.11 Screening of Corrective Measure Technologies	2-11
3.0 Necessary Laboratory and Bench-scale Studies	3-1
4.0 Evaluation of the Corrective Measures Alternatives	4-1
4.1 Technical/Environmental Human Health Institutional	4-1
4.2 Environmental	4-2
4.3 Human Health	4-2
4.4 Institutional	4-2
4.5 Cost Estimate	4-2
5.0 Justification and Recommendation of the Corrective Measures	5-1



TABLE OF CONTENTS
(Continued)

PAGE NO.

6.0 Reports	6-1
6.1 Progress Reports	6-1
6.2 Phase I CMS Report	6-1
6.3 Phase II CMS Report	6-2
6.3.1 Draft Phase II CMS Report	6-2
6.3.2 Final Phase II CMS Report	6-2

TABLE

Table 1	Receptors and Exposure Pathways
---------	---------------------------------

FIGURES

2-1	Site Location Map
2-2	Site Plan
2-3	Site Monitoring Well Locations
2-4	Check Dam Locations and Cross-Section
2-5	Proposed Sediment Sampling Locations



1.0 INTRODUCTION

Advanced GeoServices Corp. (AGC) has developed this Corrective Measures Study (CMS) Work Plan on behalf of Refined Metals Corporation (RMC) for RMC's Beech Grove, Indiana facility (Site). This CMS Work Plan has been developed as stipulated in Exhibit C of the 1998 Consent Decree between RMC and the United States Environmental Protection Agency (USEPA).

1.1 PURPOSE

The purpose of this CMS Work Plan is to document the methodologies and procedures that will be used during the Corrective Measures Study to develop and evaluate corrective action alternatives for implementation at the Site. This CMS Work Plan divided the CMS into two phases. In the first phase, additional site investigation recommended in the Phase II RFI Report will be performed and a site specific risk assessment will be conducted to establish corrective action objectives. In the second phase, the balance of the CMS will be completed.

1.2 ORGANIZATION

The CMS Work Plan addresses five tasks to be completed during the Corrective Measures Study. These tasks include:

- Identification and development of the corrective measures alternatives;
- Necessary laboratory and bench-scale studies;
- Evaluation of corrective measures alternatives;
- Justification and recommendation of the corrective measures; and,
- Reports.



2.0 IDENTIFICATION AND DEVELOPMENT OF THE CORRECTIVE MEASURES ALTERNATIVES

2.1 DESCRIPTION OF CURRENT SITUATION

The Refined Metals Corporation (RMC) facility located in Beech Grove, Indiana (Figure 2-1) was operated as a secondary lead smelter from 1968 through 1995. The facility ceased normal operations on December 31, 1995. The Site, as shown on Figure 2-2, covers approximately 24 acres, which includes approximately 10 acres where smelting operations occurred. The remainder of the Site consists of areas of lawn and woods. The former smelter area contains several structures identified as the Battery Breaker, Material Storage and Furnace, Refining, Waste Water Treatment/Filter Press, and Office Buildings. Other small structures exist including a vehicle maintenance building, baghouses, and pump sheds. Surrounding properties are occupied by a mixture of industrial/commercial properties. Currently, the Site is idle except for the waste water treatment system which remains in operation to treat storm water collected at the facility.

The RFI was completed in two phases. Phase I activities included the utilization of historical information and preliminary sampling intended to determine the presence, magnitude, extent and mobility of releases on and beneath the Site and adjacent off-site areas that may have originated from the RCRA permitted hazardous waste or solid waste management units at the Site. The Phase II RFI further defined the extent of affected soil, evaluated impacts to groundwater and implemented interim measures to prevent the off-site migration of affected soil. AGC notes that for the purposes of site evaluation and this proposed CMS, soil includes sediment within the intermittent site drainage ditches and lined lagoon. No additional sampling has been performed and no additional data generated since the Phase II RFI.

The RFI established soil concentrations of arsenic and lead above the Preliminary Remediation Goals (PRGs) and/or background levels, which were primarily restricted to the Site and the eastern edge of the adjacent parcel to the west (Citizens Gas property). Lead appears to be the primary contaminant of concern in soil. Analytical results suggest some overland transport of affected soil



in drainage features during storm events. The RFI noted incomplete delineation in the drainage ditch along Arlington Avenue east of the Site and potential off-site impact on the CSX Transportation right-of-way north of the Site. For the purposes of this report, soil refers to a solid matrix material that may include both organic and inorganic material derived from natural processes as well as former site activities (i.e. slag, dust, etc.). Sediment refers to soil that has been transported by water through drainage features during storm events. Locations where sediment will be evaluated during the CMS include the on-site storm water retention pond, the drainage ditch along Arlington Avenue, and the drainage feature along the southern boundary of the CSX Transportation right-of-way. An access agreement is being executed with CSX and additional sampling will be conducted as recommended in the Phase II RFI to complete the off-site delineation of affected soil on the railroad right-of-way as well as in the ditch along Arlington Avenue after access is obtained.

Groundwater conditions have been evaluated through the installation and sampling of nine shallow and two deep monitoring wells. Monitoring well locations are shown on Figure 2-3. Groundwater in the shallow zone of saturation near the former manufacturing area occurs as a perched layer within sandy silts contained in glacial deposits. Groundwater flow through this zone remains partially defined with components of flow toward the northeast along the eastern property boundary and to the south along the southwestern property boundary.

Two groundwater sampling events were conducted during the RFI. Lead was detected at concentrations above the Action Level in groundwater samples collected from MW-2, MW-7, and MW-8. AGC notes that field-filtering prior to sample preservation during the December 2001 sampling event yielded lead values below the Action Level. Arsenic exceeded the calculated background concentration in groundwater for all of the monitoring wells sampled, except MW-3. Field-filtering did not reduce arsenic concentrations below the calculated background concentration. This suggests that the arsenic detected in the samples is occurring in either a colloidal or dissolved state. The impact to groundwater from arsenic by former plant operations remains unclear. Arsenic concentrations detected in the groundwater were above the background values calculated from MW-9, however, whether the source of arsenic is the result of historic site operations or representative of regional background has not been determined.



In addition to the off-site soil sampling along Arlington Avenue and in the railroad right-of-way, the RFI also recommended the installation of up to three piezometers, the installation of two additional monitoring wells, and an additional groundwater sampling event for all eleven shallow wells. The purpose of the additional groundwater characterization is to better define the shallow groundwater flow direction in the northern portion of the Site and to further evaluate the occurrence of arsenic concentrations in shallow groundwater.

Based on results of the Phase I RFI activities, the USEPA determined that interim measures were necessary in a drainage ditch running north from the former manufacturing areas of the Site to the CSX right-of-way. The interim measures were detailed in a work plan dated December 20, 2000, that was approved by USEPA. Interim measures were implemented at the Site during the Phase II RFI and included the construction of four stone check dams along the alignment of a drainage ditch. The check dams were designed to retain surface water runoff and reduced velocity in order to encourage deposition of suspended solids. The check dams were installed between August 28 and 30, 2001. No permits or approvals by the State of Indiana for the construction of the check dams were required.

Following construction of the check dams, the contractor removed brush from the ditches along either side of the tracks. An as-built drawing showing the location of the check dams is included as Figure 2-4. A periodic examination of the Interim Measures indicates they are working as intended.

Based on the results of the RFI, lead and arsenic concentrations in soil exceed EPA Region IX PRGs in certain areas and may pose an unacceptable risk to human health. A site specific risk assessment is proposed in Section 2.2 to further evaluate risk to human health. Should the Site specific risk assessment confirm an unacceptable risk to human health, then ingestion of soil and/or sediment will probably be the exposure pathway and corrective measures would be required to address that pathway. The risk of exposure to affected soil varies across the Site. The former plant area is largely covered by buildings and pavement. Exposure in this area is limited to activities involving the excavation of soil from beneath the impervious ground cover, contact with soil in a few small



areas not covered by buildings or pavement, and contact with potentially impacted sediment in the lined lagoon.

If the risk assessment determines that maintaining the existing impervious surface cover provides adequate protection, a deed notice will be proposed as an institutional control. The deed notice will specify that the surface cover must be maintained by future owners and require the development of a Health and Safety Plan for workers in the event excavation below the cover is necessary.

Areas north and south of the main plant area are covered by grass and trees. Potential exposure scenarios in these areas will include trespassers and groundskeepers. As a general statement, it can be said that lead concentrations in surface soils in these areas are significantly below what was observed in the main plant area, but still include locations above relevant screening levels.

Unresolved issues remaining after the completion of the Phase II RFI include:

- The extent of affected sediment in the drainage features along Arlington Ave and the CSX right-of-way;
- The shallow groundwater flow direction in the northern portion of the Site; and,
- The determination of whether arsenic concentrations observed in groundwater are the result of former plant operations or are reflective of regional conditions based on additional groundwater sampling and discussions with local water supply authorities.

2.2 ESTABLISHMENT OF CORRECTIVE ACTION OBJECTIVES

The primary objective of the Corrective Measures Study is to screen and implement a remedy that will eliminate current and future unacceptable risk that could result from soil and groundwater contaminants at the facility. The additional objectives for the corrective actions will be to reduce the risk to human health caused by lead in soil that is presently above the USEPA's risk-based



threshold of 750 mg/kg, or to a value determined by the site-specific risk assessment that is protective of human health and the environment. Arsenic concentrations in soil will be reduced to the established background levels for the Site or to a value determined by a site-specific risk-assessment that is protective of human health and the environment.

2.3 PHASE I CORRECTIVE MEASURE STUDY ACTIVITIES

The first phase of the CMS will include the additional on- and off-site sediment sampling and groundwater investigation recommended in the Phase II RFI report. On-site sediment samples will be collected in the drainage ditch along Arlington Avenue. The sampling locations, as shown on Figure 2-5, will be north of the previously sampled location R2SED where lead concentrations exceeded the USEPA's risk-based threshold of 750 mg/kg in the 0-6 inch and 6-12 inch intervals.

The additional sampling locations will be identified as R2SED 11 through R2SED 14 and will be established using a 75-foot spacing along the center of the drainage ditch. A total of eight samples from the four locations will be collected for chemical analysis of arsenic and lead. Samples will be collected using a decontaminated hand auger at depths of 0-6 inches and 6-12 inches at each sampling location. Soil samples will be homogenized in decontaminated stainless steel bowls prior to placement into laboratory-supplied jars. Decontamination procedures will be in accordance with those presented in Appendix B of the Phase I RFI Work Plan. Sediment sampling locations will be staked for later surveying by a professional surveyor licensed in the State of Indiana.

Off-site sediment samples will be collected in a drainage feature along the south side of the CSX Transportation right-of-way north of the Site. The sampling locations, as shown on figure 2-5, will extend from Arlington Avenue along the northern boundary of the Site and will be designated as R2SB25 through R2SB30. These proposed sampling locations are approximately 200 feet apart.

A total of 12 samples from the six locations will be collected from the 0-6 inch and 6-12 inch intervals for chemical analysis of arsenic and lead. Samples will be collected using a decontaminated hand auger. Soil samples will be homogenized in decontaminated stainless steel



bowls prior to placement into laboratory-supplied jars. Decontamination procedures will be in accordance with those presented in Appendix B of the Phase I RFI Work Plan. Each location will be staked for later surveying by a professional surveyor licensed in the State of Indiana.

Additional groundwater characterization will be conducted to better define shallow groundwater flow in the northern portion of the Site. This characterization will include the installation of two additional monitoring wells. To optimize the location of these wells, AGC recommends the installation of up to three temporary piezometers. Groundwater levels will be taken within 24 hours of installation and, based on those results, the locations for two new monitoring wells will be chosen. The wells will be installed, developed, and sampled using the same techniques described in the Phase II RFI Work Plan. The temporary piezometers will be abandoned immediately after construction of the monitoring wells. No samples will be collected from the piezometers for chemical analysis because of poor data quality commonly associated with piezometers. One round of sampling for chemical analysis will be performed for all 11 shallow monitoring wells following the installation, development and a minimum of a two week stabilization period for the new wells.

Three temporary piezometers will be installed using a hollow stem auger or Geoprobe rig at the approximate locations presented on Figure 2-3. The exact locations will be chosen in the field based on rig access, but all locations will be either north or east of the former production area. The piezometers will be installed in a borehole advanced to a depth approximately 8 feet below the water table. The piezometer will be constructed using one-inch inside diameter, flush-threaded, Schedule 40, PVC riser with factory slotted, 0.01-inch slot, PVC well screen. One 10-foot length of well screen will be installed across the water table in each piezometer.

If borehole conditions permit, the piezometer screens will be sand packed to approximately two feet above the top of the screen with No. 1 sand. A bentonite seal will be installed on top of the sand pack to the surface.



The temporary piezometers will not be completed with protective covers or concrete pads since they are to be used for depth to water measurements only. Within 48 hours of installation, the PVC casings will be removed and the holes backfilled with bentonite hole plug.

Sediment and groundwater samples will be collected using protocols previously used at the site. These sampling protocols are describes in the Phase II RFI (dated December 20, 2000). Monitoring well developments purging and sampling procedures are describes in Section's 3.2.2.1, 3.2.2.2, and 3.2.2.3, respectively. Soil/sediment sampling procedures are described in Sections 3.3 and 3.4, respectively.

The purpose of the sediment sampling is to evaluate the extent of overland transport of affected sediment during storm events. The purpose of the additional groundwater investigation is to better characterize shallow groundwater flow in the northern portion of the Site and to further evaluate arsenic concentrations in groundwater. The data gathered during these activities will be added to the database and used in a human health risk assessment of direct contact exposure to arsenic and lead.

A baseline human health risk assessment will be performed following completion of the supplemental sampling activities and validation of the sampling data. Data will be validated using USEPA CLP guidance, as discussed in the RFI QAPP. Only validated data will be used for the risk assessment. The risk assessment will be conducted according to USEPA Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part A) (USEPA, 1989). The exposure areas and potential receptors to be evaluated in the risk assessment are discussed in the sections below and are summarized in Table 1. On-site, the property has been divided into three exposure areas for the purpose of this evaluation: the actual facility consisting of the plant buildings and surrounding paved areas; the grassy and wooded areas north of the main gate, and the grassy and wooded areas south of the main gate. Off-site, the Citizen's Gas property, a natural gas facility adjacent to the Site, will also be evaluated. Residential exposure in off-site residential areas will not be evaluated as part of the risk assessment because all properties (except one) within 600 feet of the Site have average surface soil lead concentrations below USEPA's residential screening level of 400 ppm.



2.4 EXPOSURE PATHWAYS AND RECEPTORS

2.4.1 Facility Area

The plant buildings and surrounding paved areas occupy approximately the central third of the RMC property. There is no exposed surface soil in this portion of the Site. Therefore, the risk assessment will evaluate a future utility worker and construction worker who could be exposed to subsurface soil. The utility worker is assumed to be exposed to subsurface soil at depths up to five feet, via incidental ingestion and dermal contact. He is assumed to have an exposure frequency of 10 days/year and an exposure duration of ten years. The construction worker engaged in activities such as excavation for foundations or earthwork will be evaluated for an exposure occurring over an entire 8-hour shift of 50 days/year for five years.

2.4.2 Grassy Areas North and South of Main Gate

The grassy and wooded areas located north and south of the main gate encompass approximately the northern and southern thirds of the RMC property. The receptors to be evaluated in both of these areas include an adolescent trespasser and an adult groundskeeper under current use, and a future site worker. These receptors are assumed to be exposed to surface soil via incidental ingestion and dermal contact. The durations and frequency of exposure have been developed based on the professional judgement of the Risk Assessor, site conditions, accessibility, etc. The adolescent trespasser (age 13-18 years) will have an exposure frequency of 25 days/year, 4 hours per day and an exposure duration of 5 years. The groundskeeper will have an exposure frequency of 50 days/year and an exposure duration of 25 years. A future site worker is assumed to spend most of his time in the plant and surrounding paved areas. However, he may have occasion to visit the grassy/wooded areas for a walk or to eat lunch at a picnic table. The worker is assumed to have an exposure frequency in these areas of 4 days/week for 36 weeks/year or 144 days/year, and an exposure duration of 25 years.



2.4.3 Offsite Natural Gas Facility

At the offsite natural gas facility, an adult commercial worker will be evaluated who is assumed to be exposed to surface soil via incidental ingestion and dermal contact. The worker is assumed to have an exposure frequency in these areas of 5 days/week for 50 weeks/year, or 225 days/year, and an exposure duration of 25 years (Table 1).

2.5 IDENTIFICATION OF CHEMICALS OF POTENTIAL CONCERN (COPCS)

The results of the Phase I RFI indicate that lead and arsenic are the main contaminants of concern in soil, both on-site and off-site. Lead and arsenic were detected in soil samples from the Site at concentrations above both residential and industrial risk-based concentrations (RBCs). The baseline risk assessment will retain lead and arsenic as COPCs in soil.

2.6 EXPOSURE ASSESSMENT

Exposure is indicated by the total amount of a chemical absorbed into the body (i.e., the dose typically in mg/kg/day), via ingestion and dermal contact. The generalized equation for calculating chemical intakes (for compounds other than lead) is shown below (USEPA, 1989):

$$I = \frac{C \cdot CR \cdot EF \cdot ED}{BW \cdot AT}$$

where:

I	=	Intake (mg/kg body weight/day)
C	=	Exposure Point Concentration (mg/kg soil)
CR	=	Contact rate, the amount of affected medium contacted per unit time or event, e.g., soil ingestion rate (mg/day)
EF	=	Exposure frequency (days/year)
ED	=	Exposure duration (yr)
BW	=	Body weight (kg)
AT	=	Averaging time (days)

Appropriate values for exposure parameters will be obtained from the following guidance documents:

- USEPA Exposure Factors Handbook Volumes I - III (EPA/600/P-95/002Fc). August 1997.
- USEPA, Office of Emergency and Remedial Response. Risk Assessment Guidance for Superfund (RAGS). Volume I: Human Health Evaluation Manual. Part E, Supplemental Guidance for Dermal Risk Assessment, Interim. EPA/540/R/99/005. September 2001.

Exposure point concentrations will be the 95% upper confidence level on the mean (95%UCL) concentration or the maximum detected concentration within each exposure area, whichever is lower.


2.7 RISK CHARACTERIZATION

Hazard Quotients (HQs) will be estimated for arsenic by dividing the average daily intake by the chemical-specific RfD. Total HI values will be estimated for each exposure area to support future remedial action decisions.

Excess Lifetime Cancer Risks (ELCRs) will be estimated for arsenic by multiplying the average daily intake by the chemical-specific cancer slope factor (CSF). A total ELCR value will be calculated for each potentially exposed population by summing the pathway-specific ELCRs. Total ELCR values will be estimated for each exposure area to support future remedial action decisions.

2.8 LEAD RISK CHARACTERIZATION

The USEPA adult lead model (USEPA, 1996) will be used to evaluate risk from exposure to lead in soil for adults and adolescents. The model considers women of child-bearing age as the most sensitive receptor to determine the potential health effects from exposure to lead at the Site. The model was developed by USEPA's Technical Review Workgroup for Lead specifically for non-residential adult exposure scenarios. The USEPA adult lead model will be used to generate an



estimate of the geometric mean blood lead levels ($\mu\text{g/dL}$) in women of child-bearing age, and the geometric standard deviation (GSD) will be used to calculate the 95th percentile blood lead level. Exposure point concentrations will be the arithmetic mean concentration of lead in soil for each exposure area. The most recent NHANES III data (Phase 2 1991-1994) for the Midwest will be used to specify the baseline blood lead level and GSD for both adolescents and adults for use in the Adult Lead Model. If predicted 95th percentile blood lead levels exceed 11 mg/dL ¹ for adults or 10 mg/dL for adolescents, an acceptable soil lead concentration will be calculated using Equation 3 of USEPA, 1996. The calculated soil lead cleanup level will be applied on average across a given exposure area.

2.9 UNCERTAINTY ANALYSIS

The uncertainty analysis will involve a qualitative description of uncertainties associated with each component of the BRA, including the site-specific factors which tend to overestimate and/or underestimate risk.

2.10 IDENTIFICATION OF THE CORRECTIVE MEASURE ALTERNATIVES

Corrective measure alternatives will be based on the corrective action objectives and the analysis of preliminary corrective measures technologies. Alternatives for on-site and off-site technologies, as well as combinations of these alternatives, will be considered to address soil and sediment in different parts of the Site and affected off-site areas. Alternatives for groundwater corrective measures, if required, will be based on similar considerations.

2.11 SCREENING OF CORRECTIVE MEASURE TECHNOLOGIES

Following completion of the first phase of the CMS (establishment of corrective action objectives) and EPA approval of the corrective action objectives, the second phase of the CMS will commence with screening of corrective measure technologies.

¹ A comparison value of 11 $\mu\text{g/dL}$ is derived from the USEPA/Centers for Disease Control and Prevention (CDC) level of concern (10 $\mu\text{g/dL}$), divided by the maternal/fetal blood ratio of 0.9 (USEPA, 1996).



estimate of the geometric mean blood lead levels ($\mu\text{g/dL}$) in women of child-bearing age, and the geometric standard deviation (GSD) will be used to calculate the 95th percentile blood lead level. Exposure point concentrations will be the arithmetic mean concentration of lead in soil for each exposure area. The most recent NHANES III data (Phase 2 1991-1994) for the Midwest will be used to specify the baseline blood lead level and GSD for both adolescents and adults for use in the Adult Lead Model. If predicted 95th percentile blood lead levels exceed 11 mg/dL ¹ for adults or 10 mg/dL for adolescents, an acceptable soil lead concentration will be calculated using Equation 3 of USEPA, 1996. The calculated soil lead cleanup level will be applied on average across a given exposure area.

2.9 UNCERTAINTY ANALYSIS

The uncertainty analysis will involve a qualitative description of uncertainties associated with each component of the BRA, including the site-specific factors which tend to overestimate and/or underestimate risk.


2.10 IDENTIFICATION OF THE CORRECTIVE MEASURE ALTERNATIVES

Corrective measure alternatives will be based on the corrective action objectives and the analysis of preliminary corrective measures technologies. Alternatives for on-site and off-site technologies, as well as combinations of these alternatives, will be considered to address soil and sediment in different parts of the Site and affected off-site areas. Alternatives for groundwater corrective measures, if required, will be based on similar considerations.

2.11 SCREENING OF CORRECTIVE MEASURE TECHNOLOGIES

Following completion of the first phase of the CMS (establishment of corrective action objectives) and EPA approval of the corrective action objectives, the second phase of the CMS will commence with screening of corrective measure technologies.

¹ A comparison value of $11 \mu\text{g/dL}$ is derived from the USEPA/Centers for Disease Control and Prevention (CDC) level of concern ($10 \mu\text{g/dL}$), divided by the maternal/fetal blood ratio of 0.9 (USEPA, 1996).



Potential corrective measure technologies for lead-affected soil were identified in the Phase I RFI Work Plan. Five of the six identified technologies will be retained for evaluation and screening during the CMS to determine their suitability for application at the Site. The retained technologies include:

1. No further action;
2. Containment;
3. Off-site disposal;
4. Resource recovery and recycling; and,
5. Stabilization/solidification.

The sixth alternative identified in the RFI Work Plan, soil washing, has been eliminated from consideration because of lack of success with soil washing on other lead impacted sites.

Potential corrective measure technologies for groundwater were not addressed by the Phase I RFI. In the event that groundwater is determined to have been degraded by arsenic resulting from former plant operations, the following remedial technologies will be considered:

1. Institutional controls;
2. In-situ treatments; and,
3. Pump and treat.

The focus of the screening process will be to eliminate technologies that are determined not to be suitable for the specific characteristics of the Site and/or waste. Limitations of each technology to achieve the remedial objectives will be noted.

Specific site characteristics that will be considered include the existing barrier already provided by the buildings and pavement over the former operational area, general site security and industrial nature of the surrounding area. Waste-specific characteristics that will be considered include the general immobility of lead and carcinogenic nature of arsenic.



In order to conduct an effective preliminary screening of available corrective measures technologies, the additional characterization recommended in the Phase II RFI and a human health risk assessment will be performed as described in Sections 2.3 through 2.9.



3.0 NECESSARY LABORATORY AND BENCH-SCALE STUDIES

Depending on the technologies selected for evaluation, laboratory and/or bench scale studies may be conducted. Such studies, if required, will be used to determine the applicability of potential corrective measure technologies to facility or contaminant characteristics and to determine the effectiveness of the alternative. For example, if off-site disposal of soil is selected, a bench scale study may be conducted to determine the leaching potential of the soil and to assure the material meets the requirements of the disposal facility.

4.0 EVALUATION OF THE CORRECTIVE MEASURES ALTERNATIVES



Potential corrective measure technologies that pass the initial screening will be further evaluated on the basis of technical, environmental, human health and institutional concerns as well as for overall costs. The evaluation of each alternative will include, as appropriate, preliminary process flow sheets; preliminary sizing and types of construction for buildings and other structures; and estimates of the type and quantities of required utilities.


4.1 TECHNICAL/ENVIRONMENTAL/HUMAN HEALTH/INSTITUTIONAL

Technical considerations for each corrective measure alternative will include performance, reliability, implementability, and safety. Performance criterion will include the ability of the alternative to perform its intended function (i.e. containment, diversion, removal, destruction, treatment, etc.). Site or waste-specific characteristics that could diminish the effectiveness of an alternative will be considered. The effectiveness of each alternative will also be evaluated based on the anticipated useful life of all components integral to the alternative.

The reliability of each alternative will be evaluated based on the operation and maintenance (O&M) requirements as well as the track record of the alternative. O&M requirements including the complexity and required scheduled maintenance will be considered. The successful use of the alternative in similar circumstances and the ability to combine the remedy with other alternatives will also be considered.

The implementability of each alternative will be evaluated based on the difficulty of installation and the time required to install and obtain the desired results from the alternative. Installation considerations will include required permits, underground utilities, depth to groundwater, equipment availability and the location of suitable off-site treatment or disposal facilities.

Safety factors that will be evaluated for each alternative include the threat posed to nearby communities, the environment, and workers during implementation. Factors that will be considered include fire, explosion and exposure to hazardous substances.



Following evaluation of the corrective measures independently, alternatives will be the subject of a comparative analysis to determine the relative performance of one alternative versus the next. Overall protection of human health and the environment and compliance with applicable regulations will be a primary determination with performance, reliability, implementability, and safety being more subjective. The Phase II CMS Report will include a narrative discussion of the comparative analysis presenting the qualitative performance of each alternative.

4.2 ENVIRONMENTAL

Each alternative will be assessed to determine short and long term beneficial and adverse effects on the environment. Considerations will include the impact on habitat types as well as plant and animal receptors located in, adjacent to, or affected by the facility. Potential impact to receptors will be evaluated on both an individual and biological community levels. Each alternative evaluation will include proposed methods to mitigate identified adverse impacts.

4.3 HUMAN HEALTH

Each alternative will be assessed with respect to the extent it mitigates short and long term exposure to residual contamination as well as the degree to which human health is protected during and after implementation. The evaluation of each alternative will characterize the on-site concentrations of contaminants and describe potential exposure routes to receptors. The predicted changes in exposure over time will also be evaluated.

4.4 INSTITUTIONAL

Each alternative will be assessed to determine how Federal, State and local environmental or public health regulations may impact the design, operation, or timing of the corrective measure.

4.5 COST ESTIMATE

A preliminary cost estimate for each alternative will be prepared that considers both capital expenditures as well as operation and maintenance costs.



Capital expenditures will include both direct and indirect costs. Direct capital costs include material and labor used in construction; equipment and services used in the treatment of affected media; and site development costs. Indirect capital costs will include engineering expenses; legal fees, licensing and permit costs; start up and shake down costs; and a contingency allowance or unforeseen circumstances.

Operation and maintenance costs will include post construction costs necessary to ensure the continued effectiveness of the corrective measure. These costs will include operating labor costs; repair parts and scheduled maintenance; supplies and utilities; subcontractor services; disposal and treatment costs of generated wastes; administrative costs; insurance, licensing fees and taxes; and a reserve or contingency fund.

5.0 JUSTIFICATION AND RECOMMENDATION OF THE CORRECTIVE MEASURES



Based on the selection process described above, a preferred corrective measure will be selected. The preferred measure may consist of more than one of the alternatives evaluated and may vary for different portions of the Site and/or affected media. Justification of the preferred corrective measure will be based on technical, human health, and environmental criteria as detailed below.

Technical criteria for the selected corrective measure will encompass performance, reliability, implementability and safety considerations. Performance will be based on the ability of the remedy to provide the intended function during the anticipated life of the remedy. Reliability will be assessed on the frequency and complexity of operational and maintenance activities that are required to keep the remedy functioning. Implementability will be assessed based on the expected time required to achieve the stated remedial goals. Safety will be assessed based on the degree to which the remedy poses a threat to nearby residents, the environment or workers.

The selected corrective measure will be protective of human health in compliance with existing USEPA criteria, standards or guidelines. Preference will be given to corrective measures that minimize potential exposure and maximize the reduction in concentrations over time.

The selected corrective measure will be protective of the environment to the extent possible by posing the least adverse impact to the environment over the shortest period of time.

6.0 REPORTS



Reporting will be provided during the corrective measures study as indicated below.

6.1 PROGRESS REPORTS

Progress reports will be provided on a monthly basis. These monthly reports will contain:

- A. A description and estimate of the percentage of the CMS completed;
- B. Summaries of all findings;
- C. Summaries of all changes made in the CMS during the reporting period;
- D. Summaries of all contacts with the representatives of the local community, public interest groups or State government during the reporting period;
- E. Summaries of all problems, potential problems and actions taken to rectify the problems;
- F. Changes in personnel during the reporting period;
- G. Projected work for the next reporting period; and,
- H. Copies of daily reports, inspection reports laboratory/monitoring data, etc.

6.2 PHASE I CMS REPORT

Following completion of the additional sediment and groundwater sampling, the analytical results and preliminary risk assessment findings will be presented in a Phase I CMS report. This report will be provided to the USEPA for review prior to the evaluation of potential corrective measures. The interim report will contain the following elements.

- A. Introduction
- B. Field Activities
- C. Analytical Results
- D. Preliminary Results of Risk Assessment
- E. Conclusions

6.0 REPORTS



Reporting will be provided during the corrective measures study as indicated below.

6.1 PROGRESS REPORTS

Progress reports will be provided on a monthly basis. These monthly reports will contain:

- A. A description and estimate of the percentage of the CMS completed;
- B. Summaries of all findings;
- C. Summaries of all changes made in the CMS during the reporting period;
- D. Summaries of all contacts with the representatives of the local community, public interest groups or State government during the reporting period;
- E. Summaries of all problems, potential problems and actions taken to rectify the problems;
- F. Changes in personnel during the reporting period;
- G. Projected work for the next reporting period; and,
- H. Copies of daily reports, inspection reports laboratory/monitoring data, etc.

6.2 PHASE I CMS REPORT

Following completion of the additional sediment and groundwater sampling, the analytical results and preliminary risk assessment findings will be presented in a Phase I CMS report. This report will be provided to the USEPA for review prior to the evaluation of potential corrective measures. The interim report will contain the following elements.

- A. Introduction
- B. Field Activities
- C. Analytical Results
- D. Preliminary Results of Risk Assessment
- E. Conclusions



6.3 PHASE II CMS REPORT

6.3.1 Draft Phase II CMS Report

The draft Phase II CMS report will include:

- A. A description of the facility, site topo map that includes depictions of plant communities, fish and wildlife habitats, and preliminary layouts;
- B. A summary of Corrective Measures including a description and selection rationale, performance expectations, preliminary design criteria and rationale, general operation and maintenance requirements and long term monitoring requirements;
- C. A summary of the RFI and impact on the selected corrective measure;
- D. A summary of necessary laboratory and bench-scale studies;
- E. Design and implementation precautions including special technical problems, additional engineering data required, permits and regulatory requirements, access/easement/right-of-way issues, health and safety requirements and community relation activities;
- F. Cost estimates for capital costs and operation and maintenance;
- G. Comparative analysis of corrective measures alternatives; and,
- H. Project schedule.

6.3.2 Final Phase II CMS Report

The final Phase II Corrective Measures Study Report will incorporate comments on the draft report received from the public and USEPA.



TABLE

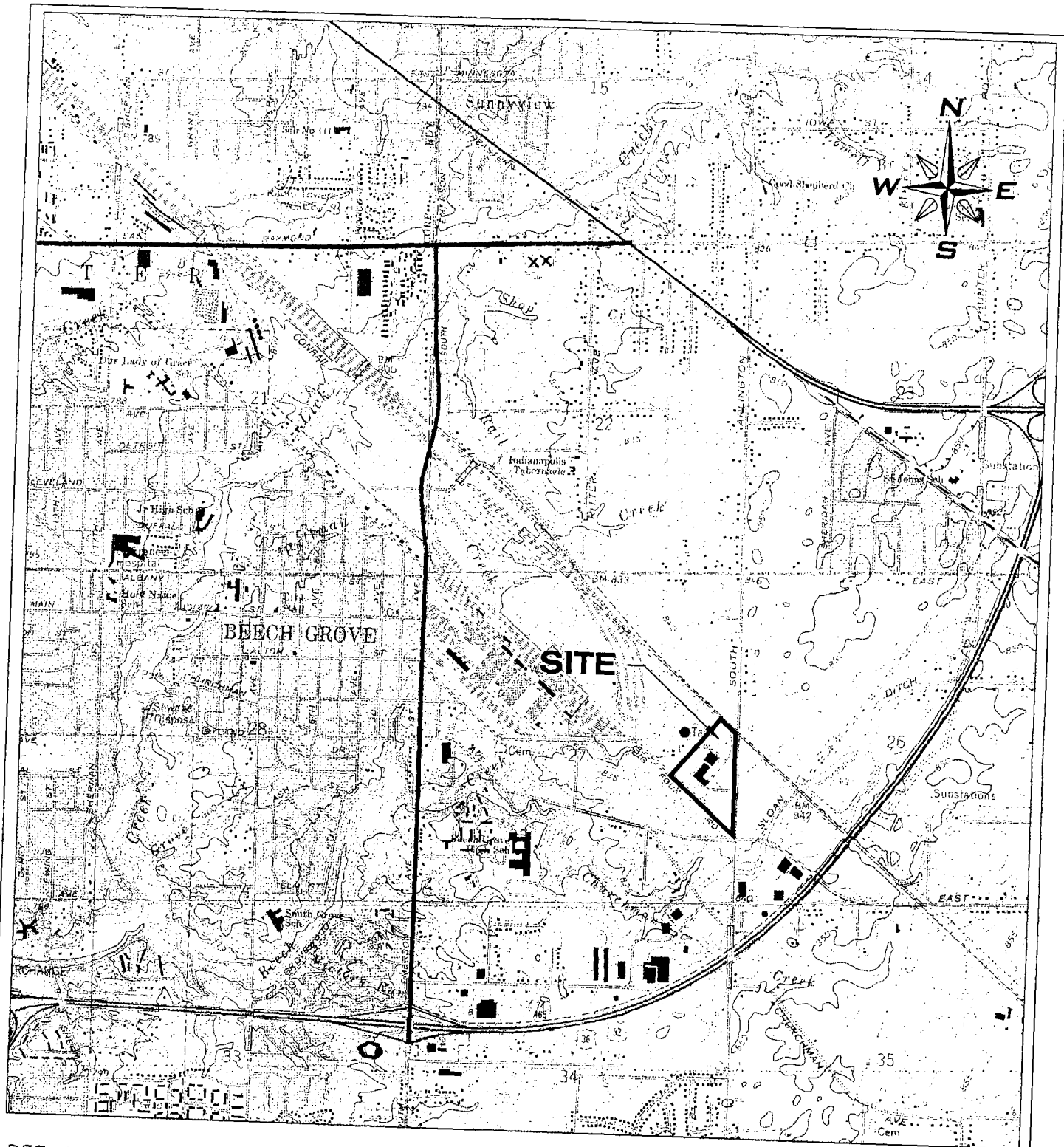


Table 1
Receptors and Exposure Pathways

Exposure Area	Media	Soil Depth	Exposure Pathways	Receptors	Exposure Frequency (days/year)	Exposure Duration (years)
Facility Area	Subsurface soil	0-5 ft	Ingestion, Dermal Contact	Utility Worker	10	10
				Construction Worker	50	5
North and South Grassy Areas	Surface soil	0-6"	Ingestion, Dermal Contact	Grounds Worker	50	25
				Trespasser (13-18 yr)	25	5
				Future Site Worker	144	25
Off Site Natural Gas Facility	Surface soil	0-6"	Ingestion, Dermal Contact	Adult (30 yr)	225	25



FIGURES




REF. U.S.G.S. 7 1/2 MINUTE
BEECH GROVE, IND
QUADRANGLE MAP

REFINED METALS CORPORATION CORRECTIVE MEASURES STUDY WORK PLAN BEECH GROVE, INDIANA

Date:	4/16/03
Scale:	N.T.S.
Drawn By:	P.S.G.
Checked By:	S.W.K.
Project Mgr:	P.G.S.
Dwg No.	20031046-2-1

SITE LOCATION MAP

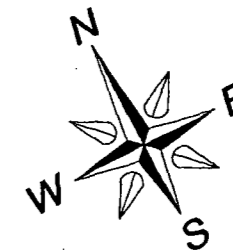
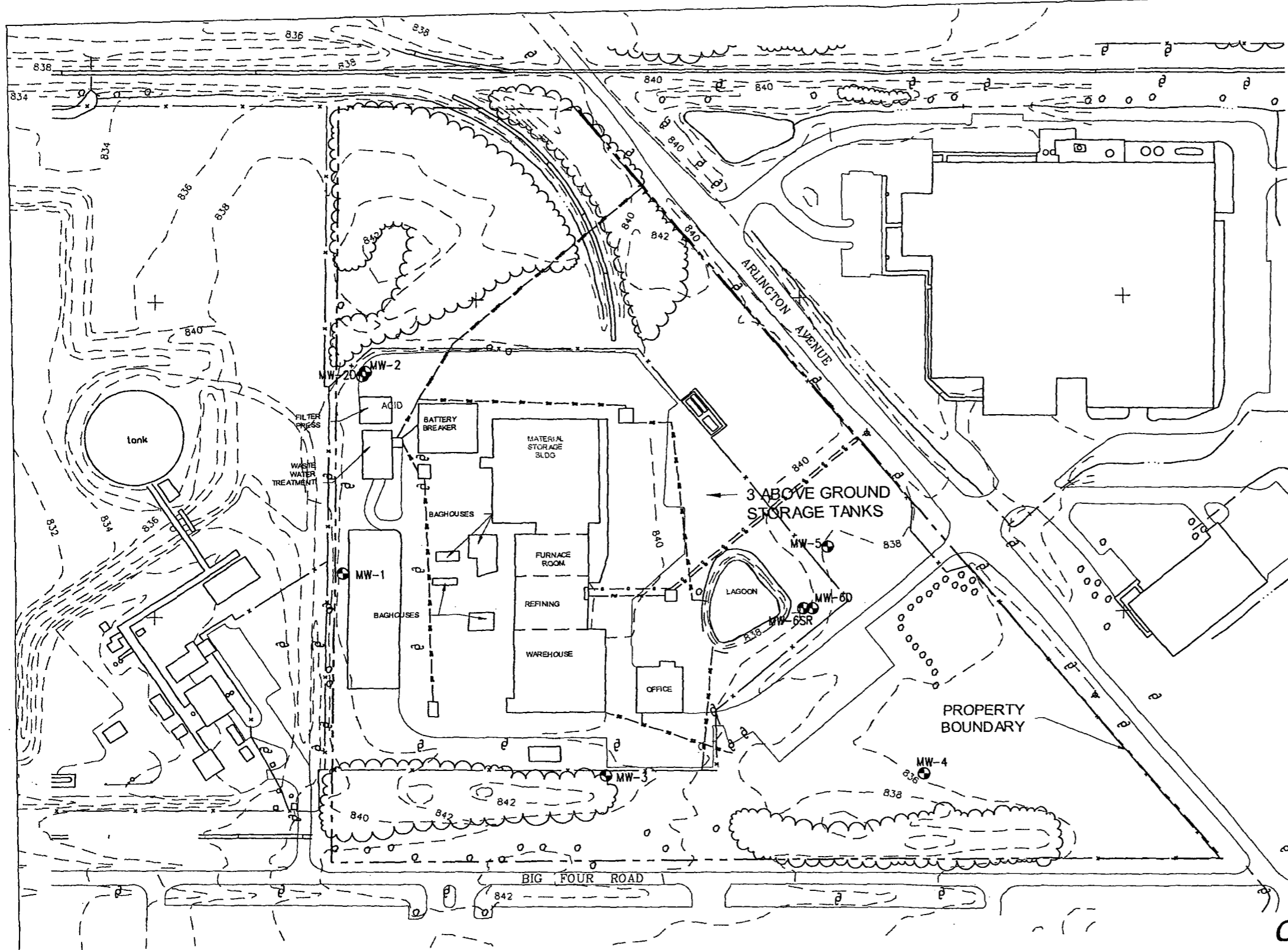


Advanced GeoServices Corp.
Chadds Ford Business Campus, Rts. 202 & 1
Brandywine One, Suite 202
Chadds Ford, Pennsylvania 19317

APR 21 2003

2003-1046-04

FIGURE: 2-1



LEGEND

⊙ MONITORING WELL LOCATION

**REFINED METALS CORPORATION
CORRECTIVE MEASURES WORK PLAN**
BEECH GROVE, IN

Scale:
1"=180'
Originated By:
B.L.
Drawn By:
V.E.N.
Checked By:
Project Mgr:
P.G.S.
Dwg. No.
20031046-2-2
APR 21 2003

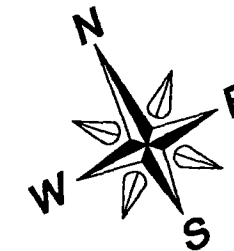
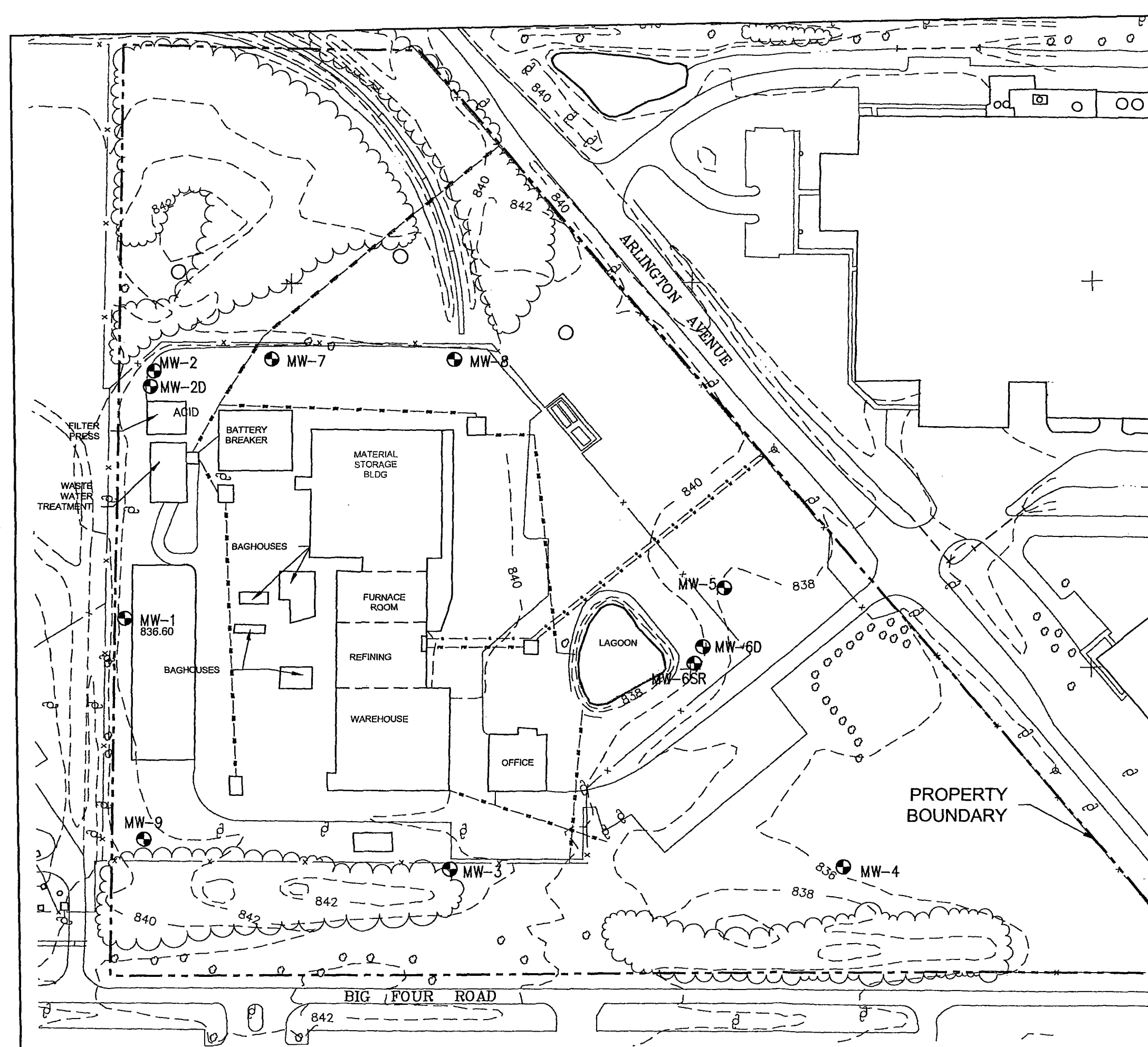
SITE PLAN



Advanced GeoServices Corp.
Chadds Ford Business Campus, Rts. 202 & 1
Brandywine One, Suite 202
Chadds Ford, Pennsylvania 19317

Project No.
2003-1046-04

FIGURE: 2-2



LEGEND

- MONITORING WELL LOCATION
- APPROXIMATE PROPOSED PIEZOMETER LOCATION

REFINED METALS CORPORATION PHASE II CLOSURE INVESTIGATION REPORT BEECH GROVE, INDIANA

Scale:
1"=130'
Originated By:
P.G.S.
Drawn By:
P.S.G.
Checked By:
J.S.W.
Project Mgr:
P.G.S.
Dwg No.
2002-1046-02-02
Issued:
JUL 11 2003

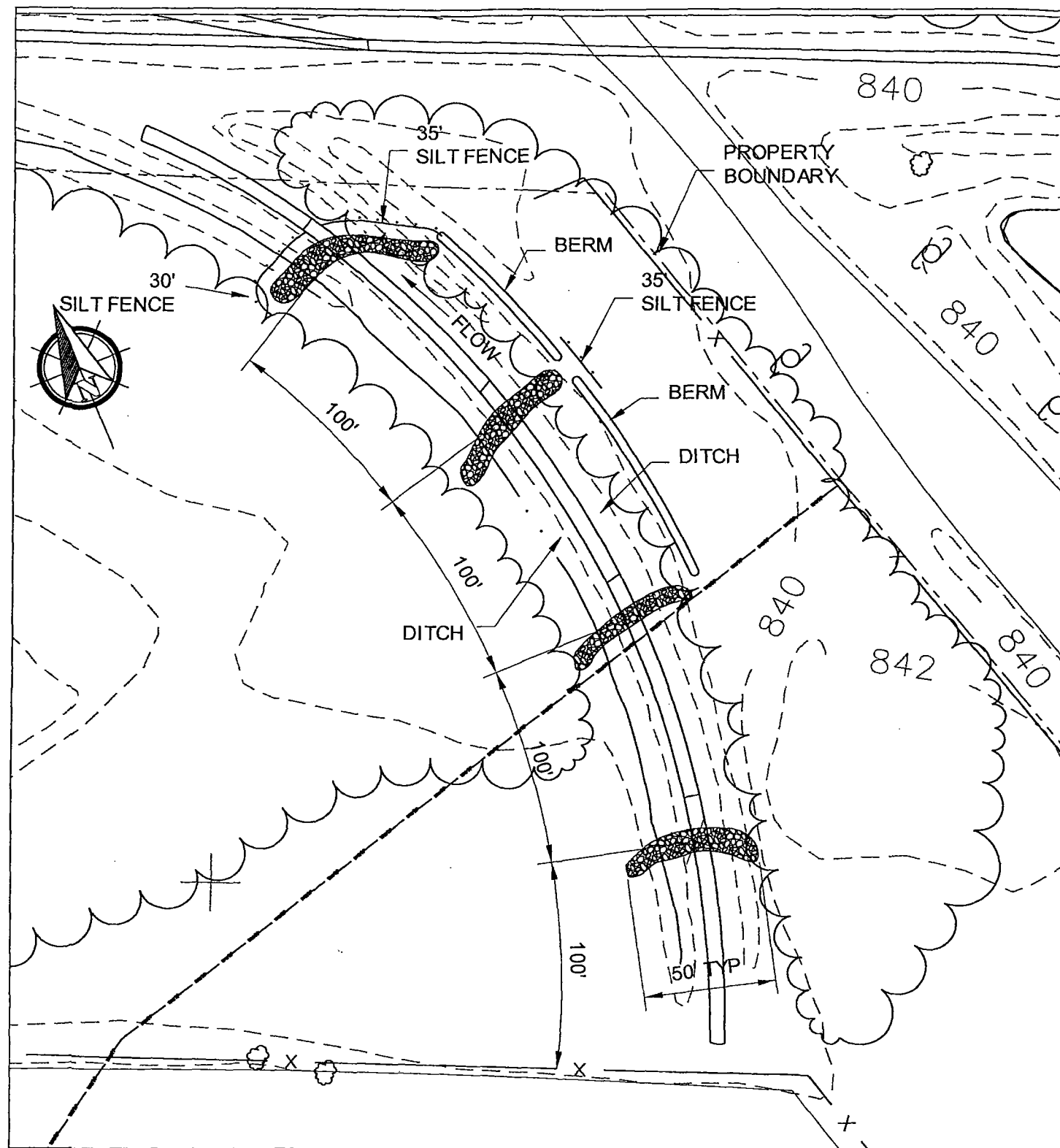
SITE MONITORING WELL LOCATIONS



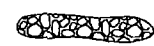
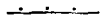
Advanced GeoServices Corp.
Chadds Ford Business Campus, Rts. 202 & 1
Brandywine One, Suite 202
Chadds Ford, Pennsylvania 19317

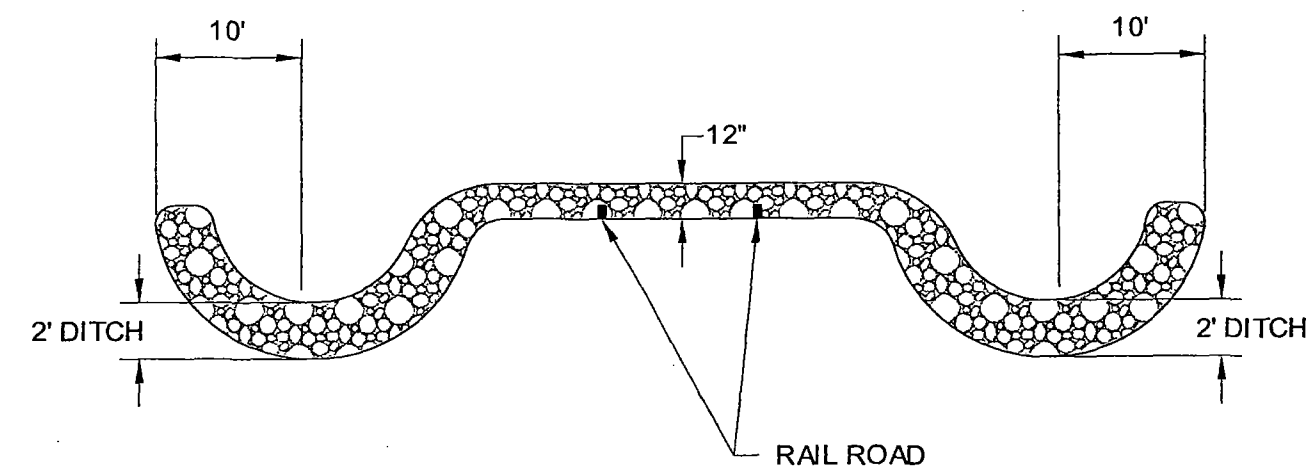
Project No.
2002-1046-02

FIGURE: 2-3



LEGEND

-  CHECK DAM
-  SILT FENCE



CHECK DAM CROSS-SECTION

REFINED METALS CORPORATION CORRECTIVE MEASURES STUDY WORK PLAN BEECH GROVE, IN

Scale:
1" = 60'
Originated By:
Drawn By:
P.S.G.
Checked By:
J.S.W.
Project Mgr:
P.G.S.
Dwg No.
20021046042-4
APR 21 2003

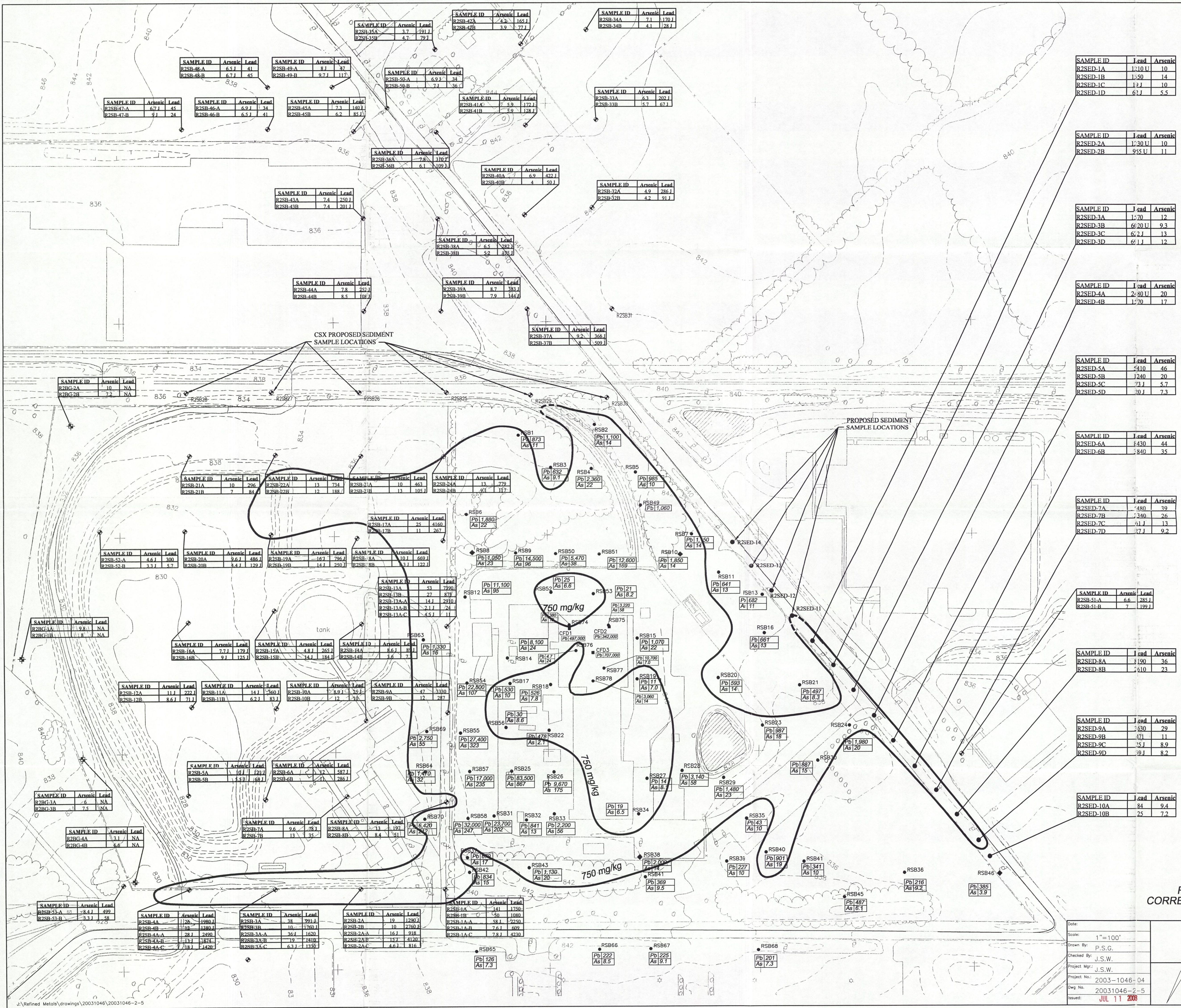
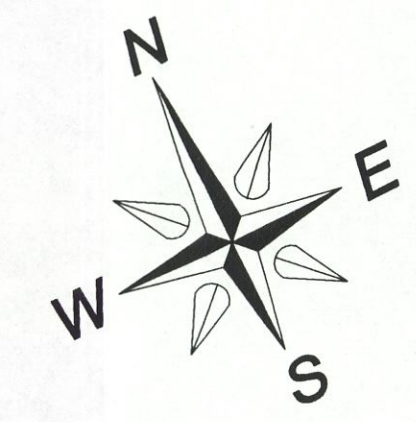
CHECK DAM LOCATIONS AND CROSS-SECTION



Advanced GeoServices Corp.
Chadds Ford Business Campus, Rts. 202 & 1
Brandywine One, Suite 202
Chadds Ford, Pennsylvania 19317

Project No.
2003-1046-04

FIGURE: 2-4



SAMPLE ID	Lead	Arsenic
R2SED-1A	1:10 U	10
R2SED-1B	1:50 U	14
R2SED-1C	1:1 U	10
R2SED-1D	6:1 U	5.5

SAMPLE ID	Lead	Arsenic
R2SED-2A	1:30 U	10
R2SED-2B	9:5 U	11

SAMPLE ID	Lead	Arsenic
R2SED-3A	1:70 U	12
R2SED-3B	6:2 U	9.3
R2SED-3C	6:2 U	13
R2SED-3D	6:1 U	12

SAMPLE ID	Lead	Arsenic
R2SED-4A	2:80 U	20
R2SED-4B	1:70 U	17

SAMPLE ID	Lead	Arsenic
R2SED-5A	5:10 U	46
R2SED-5B	1:240 U	20
R2SED-5C	7:3 U	5.7
R2SED-5D	70:1 U	7.3

SAMPLE ID	Lead	Arsenic
R2SED-6A	4:30 U	44
R2SED-6B	2:840 U	35

SAMPLE ID	Lead	Arsenic
R2SED-7A	4:80 U	39
R2SED-7B	7:340 U	26
R2SED-7C	6:1 U	13
R2SED-7D	7:1 U	9.2

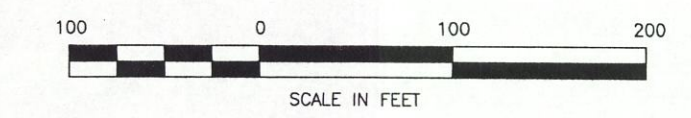
SAMPLE ID	Lead	Arsenic
R2SED-8A	6:6 U	28.1
R2SED-8B	7 U	199.1

SAMPLE ID	Lead	Arsenic
R2SED-9A	1:90 U	36
R2SED-9B	6:10 U	23

SAMPLE ID	Lead	Arsenic
R2SED-9A	7:30 U	29
R2SED-9B	7:1 U	11
R2SED-9C	5:1 U	8.9
R2SED-9D	9:1 U	8.2

SAMPLE ID	Lead	Arsenic
R2SED-10A	84 U	9.4
R2SED-10B	25 U	7.2

- LEGEND**
- RSB11 SAMPLE LOCATION/DESIGNATION SURVEYED BY THE SCHNIEDER CORP., INDIANAPOLIS, IN
 - APPROXIMATE SAMPLE LOCATION-NOT SURVEYED
 - Pb-887 ANALYTICAL RESULT-LEAD (MG/KG)
 - As-23 ANALYTICAL RESULT-ARSENIC (MG/KG)



**REFINED METALS CORPORATION
CORRECTIVE MEASURES STUDY WORK PLAN**
BEECH GROVE, IN

Date: _____
Scale: 1"=100'
Drawn By: P.S.G.
Checked By: J.S.W.
Project Mgr: J.S.W.
Project No: 2003-1046-04
Dwg No: 20031046-2-5
Issued: JUL 11 2003

Advanced GeoServices Corp.
Chadds Ford Business Campus, Rts. 202 & 1
Brandywine One, Suite 202
Chadds Ford, Pennsylvania 19317

DRAWING:

2-5



CORRECTIVE MEASURES STUDY WORK PLAN

Prepared For:

REFINED METALS CORPORATION
Beech Grove, Indiana
EPA ID ID000718130

Prepared By:

ADVANCED GEOSERVICES CORP.
Chadds Ford, Pennsylvania

Project No. 2003-1046-04
April 21, 2003



Matthew A. Love
Director, Environmental Affairs
Exide Technologies
3000 Montross Ave.
Reading, PA 19605
610.921.4054 tel
610.921.4062
fax

April 21, 2003

United States Environmental
Protection Agency -- Region V
RCRA Enforcement Branch
77 W. Jackson Street, HRE-8J
Chicago, IL 60604-3590
Attn: Mr. Jonathan Adenuga

Re: Corrective Measures Work Plan
Refined Metals Corporation
Beech Grove, Indiana

Dear Mr. Adenuga,

Please find enclosed a Corrective Measures Work Plan for the subject facility. I certify under penalty of perjury that the information contained in or accompanying the Corrective Measures Work Plan is, to the best of my knowledge after thorough investigation, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Sincerely,

EXIDE TECHNOLOGIES

A handwritten signature in black ink, appearing to read "Matthew A. Love".

Matthew A. Love
Director, Environmental Affairs

Enclosure

cc: Rebecca Joniskan -- IDEM (w. encl.)



CORRECTIVE MEASURES STUDY WORK PLAN

Prepared For:

REFINED METALS CORPORATION

Beech Grove, Indiana

EPA ID ID000718130

Prepared By:

ADVANCED GEOSERVICES CORP.

Chadds Ford, Pennsylvania

Project No. 2003-1046-04

April 21, 2003

Paul G. Stratman, P.E.
Registration No. PE 9400366

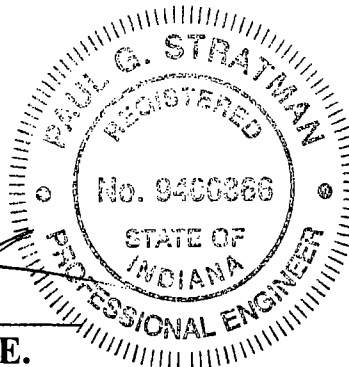




TABLE OF CONTENTS

	<u>PAGE NO.</u>
1.0 Introduction	1-1
1.1 Purpose	1-1
1.2 Organization	1-1
2.0 Identification and Development of the Corrective Measure Alternatives	2-1
2.1 Description of Current Situation	2-1
2.2 Establishment of Corrective Action Objectives	2-4
2.3 Phase I Corrective Measures Study Activities	2-5
2.4 Exposure Pathways and Receptors	2-7
2.4.1 Facility Area	2-7
2.4.2 Grassy Areas North and South of Main Gate	2-7
2.4.3 Off-site Natural Gas Facility	2-8
2.5 Identification of Chemicals of Potential Concern (COPCs)	2-8
2.6 Exposure Assessment	2-8
2.7 Risk Characterization	2-9
2.8 Lead Risk Characterization	2-9
2.9 Uncertainty Analysis	2-10
2.10 Identification of the Corrective Measure Alternatives	2-10
2.11 Screening of Corrective Measure Technologies	2-11
3.0 Necessary Laboratory and Bench-scale Studies	3-1
4.0 Evaluation of the Corrective Measures Alternatives	4-1
4.1 Technical/Environmental/Human Health/Institutional	4-1
4.2 Environmental	4-2
4.3 Human Health	4-2
4.4 Institutional	4-2
4.5 Cost Estimate	4-2
5.0 Justification and Recommendation of the Corrective Measures	5-1



TABLE OF CONTENTS
Continued

	<u>PAGE NO.</u>
6.0 Reports	6-1
6.1 Progress Reports	6-1
6.2 Draft Report	6-1
6.3 Final Report	6-2

TABLE

Table 1	Receptors and Exposure Pathways
---------	---------------------------------

FIGURES

2-1	Site Location Map
2-2	Site Plan
2-3	Site Monitoring Well Locations
2-4	Check Dam Locations and Cross-Section
2-5	Proposed Sediment Sampling Locations



1.0 INTRODUCTION

Advanced GeoServices Corp. (AGC) has developed this Corrective Measures Study (CMS) Work Plan on behalf of Refined Metals Corporation (RMC) for RMC's Beech Grove, Indiana facility (Site). This CMS Work Plan has been developed as stipulated in Exhibit C of the 1998 Consent Decree between RMC and the United States Environmental Protection Agency (USEPA).

1.1 PURPOSE

The purpose of this CMS Work Plan is to document the methodologies and procedures that will be used during the Corrective Measures Study to develop and evaluate corrective action alternatives for implementation at the Site. This CMS Work Plan divided the CMS into two phases. In the first phase, additional site investigation recommended in the Phase II RFI Report will be performed and a site specific risk assessment will be conducted to establish corrective action objectives. In the second phase, the balance of the CMS will be completed.

1.2 ORGANIZATION

The CMS Work Plan addresses five tasks to be completed during the Corrective Measures Study. These tasks include:

- Identification and development of the corrective measures alternatives;
- Necessary laboratory and bench-scale studies;
- Evaluation of corrective measures alternatives;
- Justification and recommendation of the corrective measures; and,
- Reports.



2.0 IDENTIFICATION AND DEVELOPMENT OF THE CORRECTIVE MEASURES ALTERNATIVES

2.1 DESCRIPTION OF CURRENT SITUATION

The Refined Metals Corporation (RMC) facility located in Beech Grove, Indiana (Figure 2-1) was operated as a secondary lead smelter from 1968 through 1995. The facility ceased normal operations on December 31, 1995. The Site, as shown on Figure 2-2, covers approximately 24 acres, which includes approximately 10 acres where smelting operations occurred. The remainder of the Site consists of areas of lawn and woods. The former smelter area contains several structures identified as the Battery Breaker, Material Storage and Furnace, Refining, Waste Water Treatment/Filter Press, and Office Buildings. Other small structures exist including a vehicle maintenance building, baghouses, and pump sheds. Surrounding properties are occupied by a mixture of industrial/commercial properties. Currently, the Site is idle except for the waste water treatment system which remains in operation to treat storm water collected at the facility.

The RFI was completed in two phases. Phase I activities included the utilization of historical information and preliminary sampling intended to determine the presence, magnitude, extent and mobility of releases on and beneath the Site and adjacent off-site areas that may have originated from the RCRA permitted hazardous waste or solid waste management units at the Site. The Phase II RFI further defined the extent of affected soil, evaluated impacts to groundwater and implemented interim measures to prevent the off-site migration of affected soil. AGC notes that for the purposes of site evaluation and this proposed CMS, soil includes sediment within the intermittent site drainage ditches and lined lagoon. No additional sampling has been performed and no additional data generated since the Phase II RFI.

The RFI established soil concentrations of arsenic and lead above the Preliminary Remediation Goals (PRGs) and/or background levels, which were primarily restricted to the Site and the eastern edge of the adjacent parcel to the west (Citizens Gas property). Lead appears to be the primary contaminant of concern in soil. Analytical results suggest some overland transport of affected soil



in drainage features during storm events. The RFI noted incomplete delineation in the drainage ditch along Arlington Avenue east of the Site and potential off-site impact on the CSX Transportation right-of-way north of the Site. For the purposes of this report, soil refers to a solid matrix material that may include both organic and inorganic material derived from natural processes as well as former site activities (i.e. slag, dust, etc.). Sediment refers to soil that has been transported by water through drainage features during storm events. Locations where sediment will be evaluated during the CMS include the on-site storm water retention pond, the drainage ditch along Arlington Avenue, and the drainage feature along the southern boundary of the CSX Transportation right-of-way. An access agreement is being executed with CSX and additional sampling will be conducted as recommended in the Phase II RFI to complete the off-site delineation of affected soil on the railroad right-of-way as well as in the ditch along Arlington Avenue after access is obtained.

Groundwater conditions have been evaluated through the installation and sampling of nine shallow and two deep monitoring wells. Monitoring well locations are shown on Figure 2-3. Groundwater in the shallow zone of saturation near the former manufacturing area occurs as a perched layer within sandy silts contained in glacial deposits. Groundwater flow through this zone remains partially defined with components of flow toward the northeast along the eastern property boundary and to the south along the southwestern property boundary.

Two groundwater sampling events were conducted during the RFI. Lead was detected at concentrations above the Action Level in groundwater samples collected from MW-2, MW-7, and MW-8. AGC notes that field-filtering prior to sample preservation during the December 2001 sampling event yielded lead values below the Action Level. Arsenic exceeded the calculated background concentration in groundwater for all of the monitoring wells sampled, except MW-3. Field-filtering did not reduce arsenic concentrations below the calculated background concentration. This suggests that the arsenic detected in the samples is occurring in either a colloidal or dissolved state. The impact to groundwater from arsenic by former plant operations remains unclear. Arsenic concentrations detected in the groundwater were above the background values calculated from MW-9, however, whether the source of arsenic is the result of historic site operations or representative of regional background has not been determined.




In addition to the off-site soil sampling along Arlington Avenue and in the railroad right-of-way, the RFI also recommended the installation of up to three piezometers, the installation of two additional monitoring wells, and an additional groundwater sampling event for all eleven shallow wells. The purpose of the additional groundwater characterization is to better define the shallow groundwater flow direction in the northern portion of the Site and to further evaluate the occurrence of arsenic concentrations in shallow groundwater.

Based on results of the Phase I RFI activities, the USEPA determined that interim measures were necessary in a drainage ditch running north from the former manufacturing areas of the Site to the CSX right-of-way. The interim measures were detailed in a work plan dated December 20, 2000, that was approved by USEPA. Interim measures were implemented at the Site during the Phase II RFI and included the construction of four stone check dams along the alignment of a drainage ditch. The check dams were designed to retain surface water runoff and reduced velocity in order to encourage deposition of suspended solids. The check dams were installed between August 28 and 30, 2001. No permits or approvals by the State of Indiana for the construction of the check dams were required.

Following construction of the check dams, the contractor removed brush from the ditches along either side of the tracks. An as-built drawing showing the location of the check dams is included as Figure 2-4. A periodic examination of the Interim Measures indicates they are working as intended.

Based on the results of the RFI, lead and arsenic concentrations in soil exceed EPA Region IX PRGs in certain areas and may pose an unacceptable risk to human health. A site specific risk assessment is proposed in Section 2.2 to further evaluate risk to human health. Should the Site specific risk assessment confirm an unacceptable risk to human health, then ingestion of soil and/or sediment will probably be the exposure pathway and corrective measures would be required to address that pathway. The risk of exposure to affected soil varies across the Site. The former plant area is largely covered by buildings and pavement. Exposure in this area is limited to activities involving the excavation of soil from beneath the impervious ground cover, contact with soil in a few small



areas not covered by buildings or pavement, and contact with potentially impacted sediment in the lined lagoon.

Areas north and south of the main plant area are covered by grass and trees. Potential exposure scenarios in these areas will include trespassers and groundskeepers. As a general statement, it can be said that lead concentrations in surface soils in these areas are significantly below what was observed in the main plant area, but still include locations above relevant screening levels.

Unresolved issues remaining after the completion of the Phase II RFI include:

- The extent of affected sediment in the drainage features along Arlington Ave and the CSX right-of-way;
- The shallow groundwater flow direction in the northern portion of the Site; and,
- The determination of whether arsenic concentrations observed in groundwater are the result of former plant operations or are reflective of regional conditions based on additional groundwater sampling and discussions with local water supply authorities.

2.2 ESTABLISHMENT OF CORRECTIVE ACTION OBJECTIVES

The objectives for the corrective actions will be to reduce the risk to human health caused by lead in soil that is presently above the USEPA's risk-based threshold of 750 mg/kg, or to a value determined by the site-specific risk assessment that is protective of human health and the environment. Arsenic concentrations in soil will be reduced to the established background levels for the Site or to a value determined by a site-specific risk-assessment that is protective of human health and the environment.



2.3 PHASE I CORRECTIVE MEASURE STUDY ACTIVITIES

The first phase of the CMS will include the additional on- and off-site sediment sampling and groundwater investigation recommended in the Phase II RFI report. On-site sediment samples will be collected in the drainage ditch along Arlington Avenue. The sampling locations, as shown on Figure 2-5, will be north of the previously sampled location R2SED where lead concentrations exceeded the USEPA's risk-based threshold of 750 mg/kg in the 0-6 inch and 6-12 inch intervals.

The additional sampling locations will be identified as R2SED 11 through R2SED 14 and will be established using a 75-foot spacing along the center of the drainage ditch. A total of 8 samples from the four locations will be collected for chemical analysis of arsenic and lead. Samples will be collected using a decontaminated hand auger. Soil samples will be homogenized in decontaminated stainless steel bowls prior to placement into laboratory-supplied jars. Decontamination procedures will be in accordance with those presented in Appendix B of the Phase I RFI Work Plan. Sediment sampling locations will be staked for later surveying by a professional surveyor licensed in the State of Indiana.

Off-site sediment samples will be collected in a drainage feature along the south side of the CSX Transportation right-of-way north of the Site. The sampling locations, as shown on figure 2-5, will extend from Arlington Avenue along the northern boundary of the Site and will be designated as R2SB25 through R2SB30. These proposed sampling locations are approximately 200 feet apart.

A total of 12 samples from the six locations will be collected from the 0-6 inch and 6-12 inch intervals for chemical analysis of arsenic and lead. Samples will be collected using a decontaminated hand auger. Soil samples will be homogenized in decontaminated stainless steel bowls prior to placement into laboratory-supplied jars. Decontamination procedures will be in accordance with those presented in Appendix B of the Phase I RFI Work Plan. Each location will be staked for later surveying by a professional surveyor licensed in the State of Indiana.


Additional groundwater characterization will be conducted to better define shallow groundwater



flow in the northern portion of the Site. Two additional monitoring wells. To optimize the location of these wells, AGC recommends the installation of up to three temporary piezometers. Groundwater levels will be taken within 24 hours of installation and, based on those results, the locations for two new monitoring wells will be chosen. The wells will be installed, developed, and sampled using the same techniques described in the Phase II RFI Work Plan. The temporary piezometers will be abandoned immediately after construction of the monitoring wells. No samples will be collected from the piezometers for chemical analysis because of poor data quality commonly associated with piezometers. One round of sampling for chemical analysis will be performed for all 11 shallow monitoring wells following the installation, development and a minimum of a two week stabilization period for the new wells. Sampling protocols previously used at the Site will be followed.

The purpose of the sediment sampling is to evaluate the extent of overland transport of affected sediment during storm events. The purpose of the additional groundwater investigation is to better characterize shallow groundwater flow in the northern portion of the Site and to further evaluate arsenic concentrations in groundwater. The data gathered during these activities will be added to the database and used in a human health risk assessment of direct contact exposure to arsenic and lead.

A baseline human health risk assessment will be performed following completion of the supplemental sampling activities and validation of the sampling data. Data will be validated using USEPA CLP guidance, as discussed in the RFI QAPP. Only validated data will be used for the risk assessment. The risk assessment will be conducted according to USEPA Risk Assessment Guidance for Superfund (RAGS) Volume I: Human Health Evaluation Manual (Part A) (USEPA, 1989). The exposure areas and potential receptors to be evaluated in the risk assessment are discussed in the sections below and are summarized in Table 1. On-site, the property has been divided into three exposure areas for the purpose of this evaluation: the actual facility consisting of the plant buildings and surrounding paved areas; the grassy and wooded areas north of the main gate, and the grassy and wooded areas south of the main gate. Off-site, the Citizen's Gas property, a natural gas facility adjacent to the Site, will also be evaluated. Residential exposure in off-site residential areas will not



be evaluated as part of the risk assessment because all properties (except one) within 600 feet of the Site have average surface soil lead concentrations below USEPA's residential screening level of 400 ppm.

2.4 EXPOSURE PATHWAYS AND RECEPTORS

2.4.1 Facility Area

The plant buildings and surrounding paved areas occupy approximately the central third of the RMC property. There is no exposed surface soil in this portion of the Site. Therefore, the risk assessment will evaluate a future utility worker who could be exposed to subsurface soil. The utility worker is assumed to be exposed to subsurface soil at depths up to five feet, via incidental ingestion and dermal contact. He is assumed to have an exposure frequency of 10 days/year and an exposure duration of 10 years.

2.4.2 Grassy Areas North and South of Main Gate

The grassy and wooded areas located north and south of the main gate encompass approximately the northern and southern thirds of the RMC property. The receptors to be evaluated in both of these areas include an adolescent trespasser and an adult groundskeeper under current use, and a future site worker. These receptors are assumed to be exposed to surface soil via incidental ingestion and dermal contact. The adolescent trespasser (age 13-18 years) will have an exposure frequency of 25 days/year, 4 hours per day and an exposure duration of 5 years. The groundskeeper will have an exposure frequency of 50 days/year and an exposure duration of 25 years. A future site worker is assumed to spend most of his time in the plant and surrounding paved areas. However, he may have occasion to visit the grassy/wooded areas for a walk or to eat lunch at a picnic table. The worker is assumed to have an exposure frequency in these areas of 4 days/week for 36 weeks/year or 144 days/year, and an exposure duration of 25 years.



2.4.3 Offsite Natural Gas Facility

At the offsite natural gas facility, an adult commercial worker will be evaluated who is assumed to be exposed to surface soil via incidental ingestion and dermal contact. The worker is assumed to have an exposure frequency in these areas of 5 days/week for 50 weeks/year, or 225 days/year, and an exposure duration of 25 years (Table 1).

2.5 IDENTIFICATION OF CHEMICALS OF POTENTIAL CONCERN (COPCS)

The results of the Phase I RFI indicate that lead and arsenic are the main contaminants of concern in soil, both on-site and off-site. Lead and arsenic were detected in soil samples from the Site at concentrations above both residential and industrial risk-based concentrations (RBCs). The baseline risk assessment will retain lead and arsenic as COPCs in soil.


2.6 EXPOSURE ASSESSMENT

Exposure is indicated by the total amount of a chemical absorbed into the body (i.e., the dose typically in mg/kg/day), via ingestion and dermal contact. The generalized equation for calculating chemical intakes (for compounds other than lead) is shown below (USEPA, 1989):

$$I = \frac{C \cdot CR \cdot EF \cdot ED}{BW \cdot AT}$$

where:

I	=	Intake (mg/kg body weight/day)
C	=	Exposure Point Concentration (mg/kg soil)
CR	=	Contact rate, the amount of affected medium contacted per unit time or event, e.g., soil ingestion rate (mg/day)
EF	=	Exposure frequency (days/year)
ED	=	Exposure duration (yr)
BW	=	Body weight (kg)
AT	=	Averaging time (days)



Appropriate values for exposure parameters will be obtained from the following guidance documents:

- USEPA Exposure Factors Handbook Volumes I - III (EPA/600/P-95/002Fc). August 1997.
- USEPA, Office of Emergency and Remedial Response. Risk Assessment Guidance for Superfund (RAGS). Volume I: Human Health Evaluation Manual. Part E, Supplemental Guidance for Dermal Risk Assessment, Interim. EPA/540/R/99/005. September 2001.

Exposure point concentrations will be the 95% upper confidence level on the mean (95%UCL) concentration or the maximum detected concentration within each exposure area, whichever is lower.

2.7 RISK CHARACTERIZATION

Hazard Quotients (HQs) will be estimated for arsenic by dividing the average daily intake by the chemical-specific RfD. Total HI values will be estimated for each exposure area to support future remedial action decisions.

Excess Lifetime Cancer Risks (ELCRs) will be estimated for arsenic by multiplying the average daily intake by the chemical-specific cancer slope factor (CSF). A total ELCR value will be calculated for each potentially exposed population by summing the pathway-specific ELCRs. Total ELCR values will be estimated for each exposure area to support future remedial action decisions.

2.8 LEAD RISK CHARACTERIZATION

The USEPA adult lead model (USEPA, 1996) will be used to evaluate risk from exposure to lead in soil for adults and adolescents. The model considers women of child-bearing age as the most sensitive receptor to determine the potential health effects from exposure to lead at the Site. The model was developed by USEPA's Technical Review Workgroup for Lead specifically for non-residential adult exposure scenarios. The USEPA adult lead model will be used to generate an



estimate of the geometric mean blood lead levels ($\mu\text{g/dL}$) in women of child-bearing age, and the geometric standard deviation (GSD) will be used to calculate the 95th percentile blood lead level. Exposure point concentrations will be the arithmetic mean concentration of lead in soil for each exposure area. The most recent NHANES III data (Phase 2 1991-1994) for the Midwest will be used to specify the baseline blood lead level and GSD for both adolescents and adults for use in the Adult Lead Model. If predicted 95th percentile blood lead levels exceed 11 mg/dL ¹ for adults or 10 mg/dL for adolescents, an acceptable soil lead concentration will be calculated using Equation 3 of USEPA, 1996. The calculated soil lead cleanup level will be applied on average across a given exposure area.

2.9 UNCERTAINTY ANALYSIS

The uncertainty analysis will involve a qualitative description of uncertainties associated with each component of the BRA, including the site-specific factors which tend to overestimate and/or underestimate risk.

2.10 IDENTIFICATION OF THE CORRECTIVE MEASURE ALTERNATIVES

Corrective measure alternatives will be based on the corrective action objectives and the analysis of preliminary corrective measures technologies. Alternatives for on-site and off-site technologies, as well as combinations of these alternatives, will be considered to address soil and sediment in different parts of the Site and affected off-site areas. Alternatives for groundwater corrective measures, if required, will be based on similar considerations.

¹ A comparison value of 11 $\mu\text{g/dL}$ is derived from the USEPA/Centers for Disease Control and Prevention (CDC) level of concern (10 $\mu\text{g/dL}$), divided by the maternal/fetal blood ratio of 0.9 (USEPA, 1996).



2.11 SCREENING OF CORRECTIVE MEASURE TECHNOLOGIES

Following completion of the first phase of the CMS (establishment of corrective action objectives) and EPA approval of the corrective action objectives, the second phase of the CMS will commence with screening of corrective measure technologies.

Potential corrective measure technologies for lead-affected soil were identified in the Phase I RFI Work Plan. Five of the six identified technologies will be retained for evaluation and screening during the CMS to determine their suitability for application at the Site. The retained technologies include:

1. No further action;
2. Containment;
3. Off-site disposal;
4. Resource recovery and recycling; and,
5. Stabilization/solidification.

The sixth alternative identified in the RFI Work Plan, soil washing, has been eliminated from consideration because of lack of success with soil washing on other lead impacted sites.

Potential corrective measure technologies for groundwater were not addressed by the Phase I RFI. In the event that groundwater is determined to have been degraded by arsenic resulting from former plant operations, the following remedial technologies will be considered:

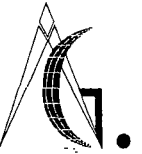
1. Institutional controls;
2. In-situ treatments; and,
3. Pump and treat.

The focus of the screening process will be to eliminate technologies that are determined not to be suitable for the specific characteristics of the Site and/or waste. Limitations of each technology to achieve the remedial objectives will be noted.



Specific site characteristics that will be considered include the existing barrier already provided by the buildings and pavement over the former operational area, general site security and industrial nature of the surrounding area. Waste-specific characteristics that will be considered include the general immobility of lead and carcinogenic nature of arsenic.

In order to conduct an effective preliminary screening of available corrective measures technologies, the additional characterization recommended in the Phase II RFI and a human health risk assessment will be performed as described below.



3.0 NECESSARY LABORATORY AND BENCH-SCALE STUDIES

Depending on the technologies selected for evaluation, laboratory and/or bench scale studies may be conducted. Such studies, if required, will be used to determine the applicability of potential corrective measure technologies to facility or contaminant characteristics and to determine the effectiveness of the alternative. For example, if off-site disposal of soil is selected, a bench scale study may be conducted to determine the leaching potential of the soil and to assure the material meets the requirements of the disposal facility.



4.0 EVALUATION OF THE CORRECTIVE MEASURES ALTERNATIVES

Potential corrective measure technologies that pass the initial screening will be further evaluated on the basis of technical, environmental, human health and institutional concerns as well as for overall costs. The evaluation of each alternative will include, as appropriate, preliminary process flow sheets; preliminary sizing and types of construction for buildings and other structures; and estimates of the type and quantities of required utilities.

4.1 TECHNICAL/ENVIRONMENTAL/HUMAN HEALTH/INSTITUTIONAL

Technical considerations for each corrective measure alternative will include performance, reliability, implementability, and safety. Performance criterion will include the ability of the alternative to perform its intended function (i.e. containment, diversion, removal, destruction, treatment, etc.). Site or waste-specific characteristics that could diminish the effectiveness of an alternative will be considered. The effectiveness of each alternative will also be evaluated based on the anticipated useful life of all components integral to the alternative.

The reliability of each alternative will be evaluated based on the operation and maintenance (O&M) requirements as well as the track record of the alternative. O&M requirements including the complexity and required scheduled maintenance will be considered. The successful use of the alternative in similar circumstances and the ability to combine the remedy with other alternatives will also be considered.

The implementability of each alternative will be evaluated based on the difficulty of installation and the time required to install and obtain the desired results from the alternative. Installation considerations will include required permits, underground utilities, depth to groundwater, equipment availability and the location of suitable off-site treatment or disposal facilities.

Safety factors that will be evaluated for each alternative include the threat posed to nearby communities, the environment, and workers during implementation. Factors that will be considered include fire, explosion and exposure to hazardous substances.



4.2 ENVIRONMENTAL

Each alternative will be assessed to determine short and long term beneficial and adverse effects on the environment. Considerations will include the impact on habitat types as well as plant and animal receptors located in, adjacent to, or affected by the facility. Potential impact to receptors will be evaluated on both an individual and biological community levels. Each alternative evaluation will include proposed methods to mitigate identified adverse impacts.

4.3 HUMAN HEALTH

Each alternative will be assessed with respect to the extent it mitigates short and long term exposure to residual contamination as well as the degree to which human health is protected during and after implementation. The evaluation of each alternative will characterize the on-site concentrations of contaminants and describe potential exposure routes to receptors. The predicted changes in exposure over time will also be evaluated.

4.4 INSTITUTIONAL

Each alternative will be assessed to determine how Federal, State and local environmental or public health regulations may impact the design, operation, or timing of the corrective measure.

4.5 COST ESTIMATE

A preliminary cost estimate for each alternative will be prepared that considers both capital expenditures as well as operation and maintenance costs.

Capital expenditures will include both direct and indirect costs. Direct capital costs include material and labor used in construction; equipment and services used in the treatment of affected media; and site development costs. Indirect capital costs will include engineering expenses; legal fees, licensing and permit costs; start up and shake down costs; and a contingency allowance or unforeseen circumstances.



Operation and maintenance costs will include post construction costs necessary to ensure the continued effectiveness of the corrective measure. These costs will include operating labor costs; repair parts and scheduled maintenance; supplies and utilities; subcontractor services; disposal and treatment costs of generated wastes; administrative costs; insurance, licencing fees and taxes; and a reserve or contingency fund.

5.0 JUSTIFICATION AND RECOMMENDATION OF THE CORRECTIVE MEASURES



Based on the selection process described above, a preferred corrective measure will be selected. The preferred measure may consist of more than one of the alternatives evaluated and may vary for different portions of the Site and/or affected media. Justification of the preferred corrective measure will be based on technical, human health, and environmental criteria as detailed below.

Technical criteria for the selected corrective measure will encompass performance, reliability, implementability and safety considerations. Performance will be based on the ability of the remedy to provide the intended function during the anticipated life of the remedy. Reliability will be assessed on the frequency and complexity of operational and maintenance activities that are required to keep the remedy functioning. Implementability will be assessed based on the expected time required to achieve the stated remedial goals. Safety will be assessed based on the degree to which the remedy poses a threat to nearby residents, the environment or workers.

The selected corrective measure will be protective of human health in compliance with existing USEPA criteria, standards or guidelines. Preference will be given to corrective measures that minimize potential exposure and maximize the reduction in concentrations over time.

The selected corrective measure will be protective of the environment to the extent possible by posing the least adverse impact to the environment over the shortest period of time.



6.0 REPORTS

Reporting will be provided during the corrective measures study as indicated below.

6.1 PROGRESS REPORTS

Progress reports will be provided on a monthly basis. These monthly reports will contain:

- A. A description and estimate of the percentage of the CMS completed;
- B. Summaries of all findings;
- C. Summaries of all changes made in the CMS during the reporting period;
- D. Summaries of all contacts with the representatives of the local community, public interest groups or State government during the reporting period;
- E. Summaries of all problems, potential problems and actions taken to rectify the problems;
- F. Changes in personnel during the reporting period;
- G. Projected work for the next reporting period; and,
- H. Copies of daily reports, inspection reports laboratory/monitoring data, etc.

6.2 DRAFT REPORT

The draft CMS report will include:

- A. A description of the facility, site topo map that includes depictions of plant communities, fish and wildlife habitats, and preliminary layouts;
- B. A summary of Corrective Measures including a description and selection rationale, performance expectations, preliminary design criteria and rationale, general operation and maintenance requirements and long term monitoring requirements;
- C. A summary of the RFI and impact on the selected corrective measure;



- D. A summary of necessary laboratory and bench-scale studies;
- E. Design and implementation precautions including special technical problems, additional engineering data required, permits and regulatory requirements, access/easement/right-of-way issues, health and safety requirements and community relation activities;
- F. Cost estimates for capital costs and operation and maintenance; and,
- G. Project schedule.

6.3 FINAL REPORT

The final Corrective Measures Study Report will incorporate comments on the draft report received from the public and USEPA.



TABLE

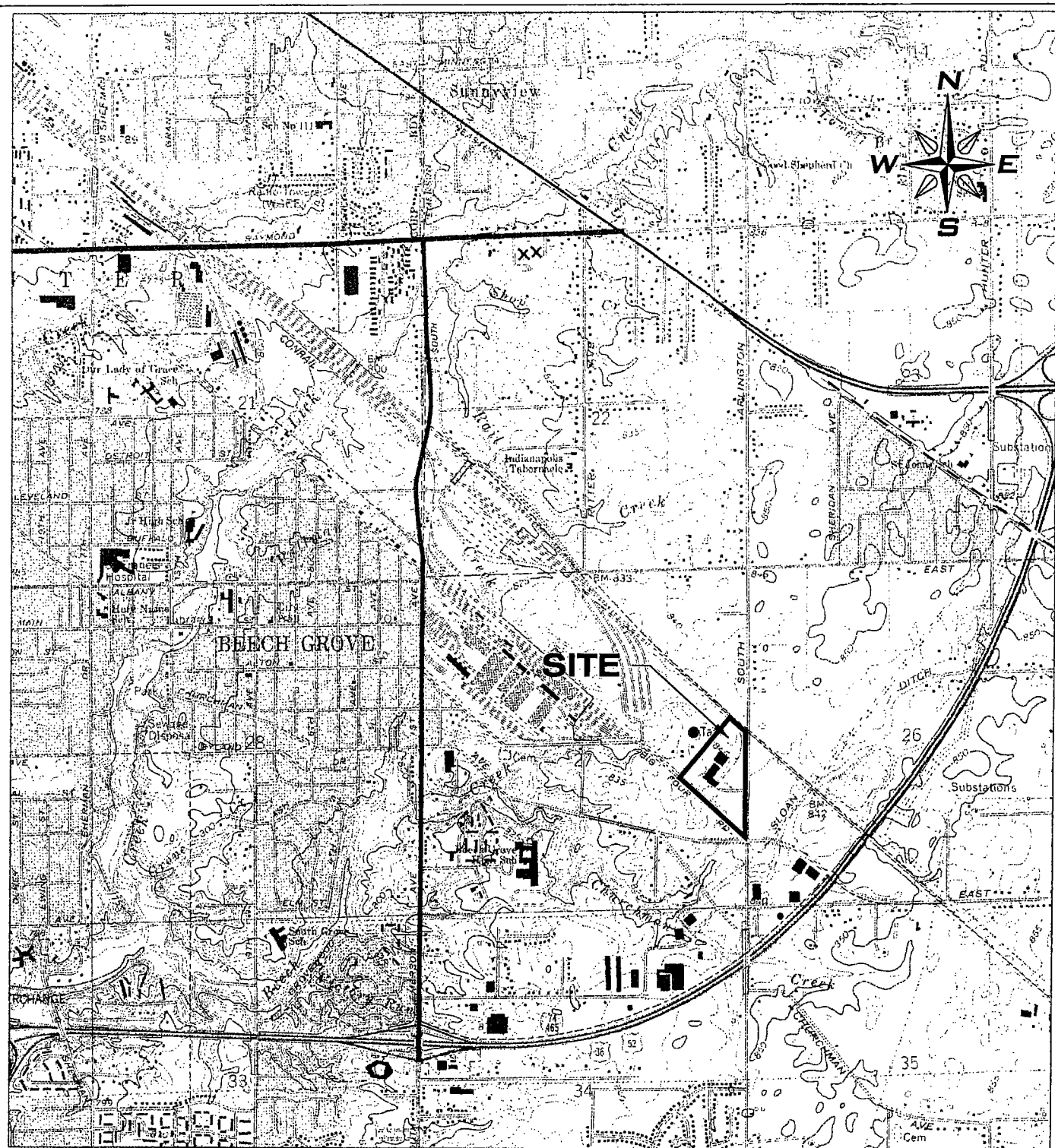


Table 1
Receptors and Exposure Pathways

Exposure Area	Media	Soil Depth	Exposure Pathways	Receptors	Exposure Frequency (days/year)	Exposure Duration (years)
Facility Area	Subsurface soil	0-5 ft	Ingestion, Dermal Contact	Utility Worker	10	10
North and South Grassy Areas	Surface soil	0-6"	Ingestion, Dermal Contact	Grounds Worker	50	25
				Trespasser (13-18 yr)	25	5
				Future Site Worker	144	25
Off Site Natural Gas Facility	Surface soil	0-6"	Ingestion, Dermal Contact	Adult (30 yr)	225	25



FIGURES



REF. U.S.G.S. 7 1/2 MINUTE
BEECH GROVE, IND
QUADRANGLE MAP

REFINED METALS CORPORATION **CORRECTIVE MEASURES STUDY WORK PLAN** BEECH GROVE, INDIANA

Date:
4/16/03

Scale:
N.T.S.


Drawn By:
P.S.G.

Checked By:
S.W.K.

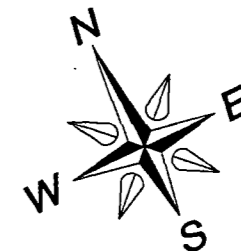
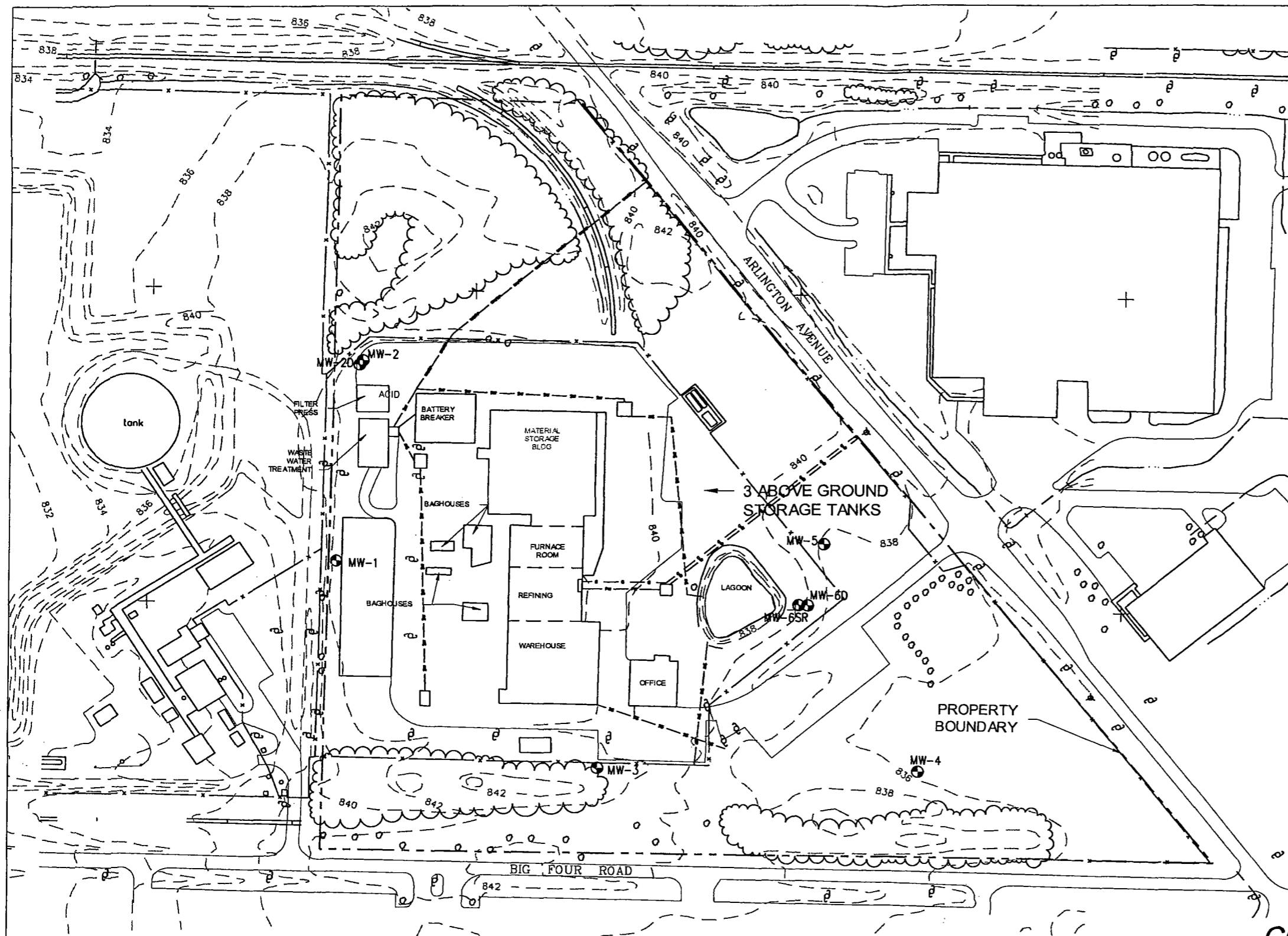
Project Mgr:
P.G.S.

Dwg No.
20031046-2-1

SITE LOCATION MAP

 **Advanced GeoServices Corp.**
Chadds Ford Business Campus, Rts. 202 & 1
Brandywine One, Suite 202
Chadds Ford, Pennsylvania 19317

Project No.
2003-1046-04



LEGEND

● MONITORING WELL LOCATION

REFINED METALS CORPORATION CORRECTIVE MEASURES WORK PLAN BEECH GROVE, IN

Scale:
1"=180'
Originated By:
B.L.
Drawn By:
V.E.N.
Checked By:
Project Mgr:
P.G.S.
Dwg No.
20031046-2-2

SITE PLAN

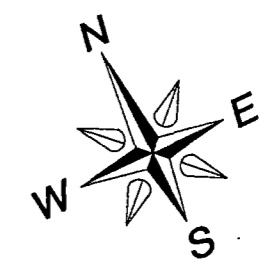
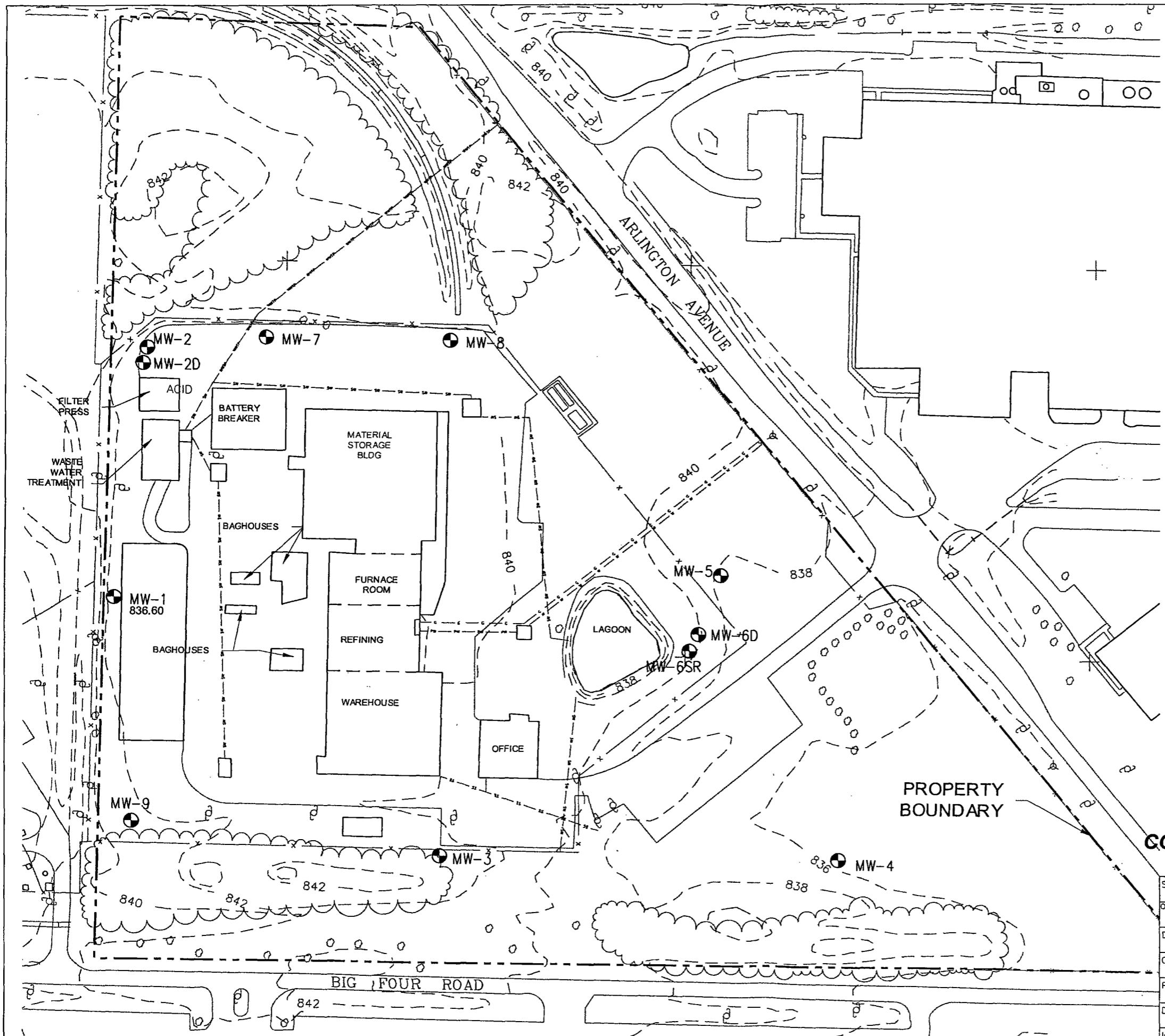


Advanced GeoServices Corp.
Chadds Ford Business Campus, Rts. 202 & 1
Brandywine One, Suite 202
Chadds Ford, Pennsylvania 19317

APR 21 2003

2003-1046-04

FIGURE: 2-2



LEGEND

● MONITORING WELL LOCATION

**REFINED METALS CORPORATION
CORRECTIVE MEASURES STUDY WORK PLAN**
BEECH GROVE, INDIANA

Scale:
1"=130'

Originated By:
P.G.S.


Drawn By:
P.G.S.

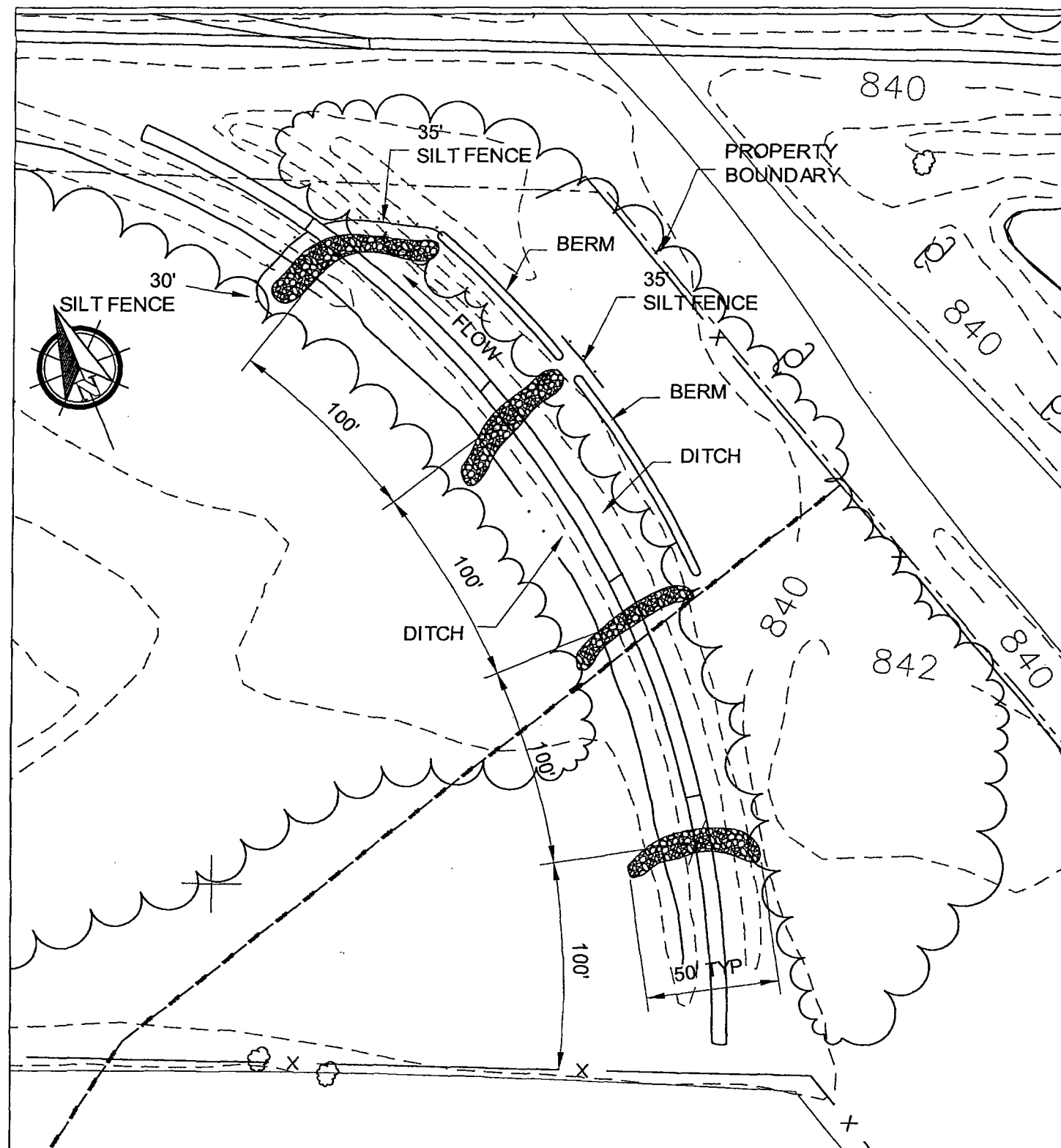
Checked By:
J.S.W.

Project Mgr:
P.G.S.

Dwg No.
2003-1046-2-3

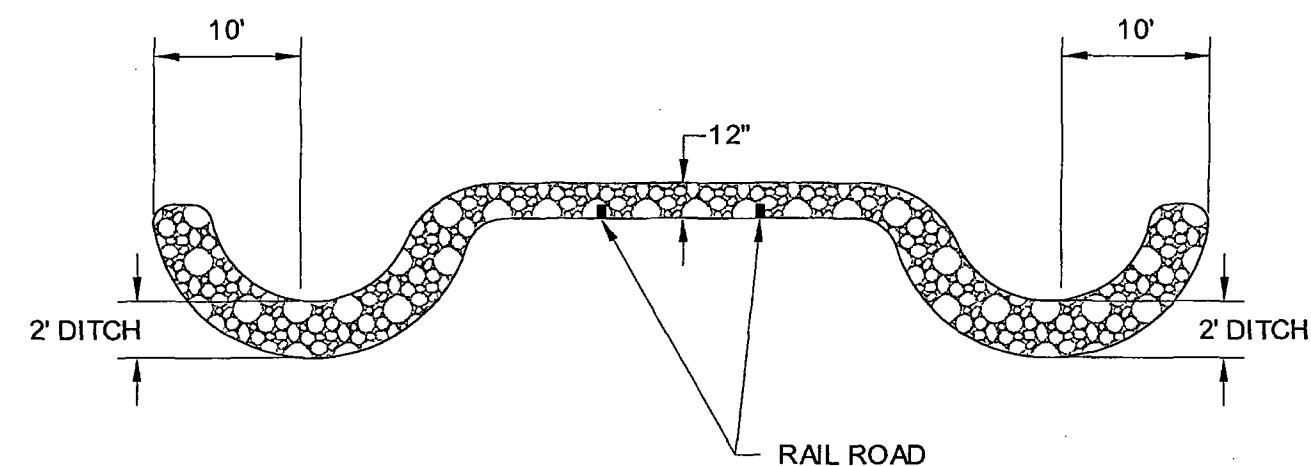
Issued:
APR 21 2003

SITE MONITORING WELL LOCATIONS	
	Advanced GeoServices Corp. Chadds Ford Business Campus, Rts. 202 & 1 Brandywine One, Suite 202 Chadds Ford, Pennsylvania 19317
	Project No. 2003-1046-04
	FIGURE: 2-3




LEGEND

- CHECK DAM
- SILT FENCE

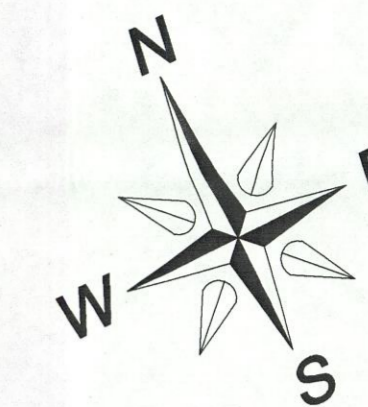


CHECK DAM CROSS-SECTION

REFINED METALS CORPORATION CORRECTIVE MEASURES STUDY WORK PLAN BEECH GROVE, IN

Scale: 1" = 60'	CHECK DAM LOCATIONS AND CROSS-SECTION
Originated By:	
Drawn By: P.S.G.	 Advanced GeoServices Corp. Chadds Ford Business Campus, Rts. 202 & 1 Brandywine One, Suite 202 Chadds Ford, Pennsylvania 19317
Checked By: J.S.W.	
Project Mgr: P.G.S.	
Dwg. No. 20021046042-4	
Project No. 2003-1046-04	FIGURE: 2-4

APR 21 2003



SAMPLE ID	Lead	Arsenic
R2SED-1A	1210 U	10
R2SED-1B	1550 U	14
R2SED-1C	19 U	10
R2SED-1D	62 U	5.5

SAMPLE ID	Lead	Arsenic
R2SED-2A	1230 U	10
R2SED-2B	955 U	11

SAMPLE ID	Lead	Arsenic
R2SED-3A	1570	12
R2SED-3B	6020 U	9.3
R2SED-3C	622 U	13
R2SED-3D	691 U	12

SAMPLE ID	Lead	Arsenic
R2SED-4A	2480 U	20
R2SED-4B	1570	17

SAMPLE ID	Lead	Arsenic
R2SED-5A	5410	46
R2SED-5B	1240	20
R2SED-5C	73 U	5.7
R2SED-5D	20 U	7.3

SAMPLE ID	Lead	Arsenic
R2SED-6A	8430	44
R2SED-6B	3840	35

SAMPLE ID	Lead	Arsenic
R2SED-7A	5480	39
R2SED-7B	2340	26
R2SED-7C	61 U	13
R2SED-7D	27 U	9.2

SAMPLE ID	Lead	Arsenic
R2SB-51-A	6.6	285 U
R2SB-51-B	7	199 U

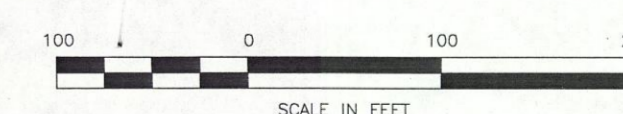
SAMPLE ID	Lead	Arsenic
R2SED-8A	8190	36
R2SED-8B	2610	23

SAMPLE ID	Lead	Arsenic
R2SED-9A	3630	29
R2SED-9B	471	11
R2SED-9C	25 U	8.9
R2SED-9D	39 U	8.2

SAMPLE ID	Lead	Arsenic
R2SED-10A	84	9.4
R2SED-10B	25	7.2

LEGEND

- RSB11 SAMPLE LOCATION/DESIGNATION SURVEYED BY THE SCHNIEDER CORP., INDIANAPOLIS, IN
- APPROXIMATE SAMPLE LOCATION-NOT SURVEYED
- Pb-887 ANALYTICAL RESULT-LEAD (MG/KG)
- As-23 ANALYTICAL RESULT-ARSENIC (MG/KG)



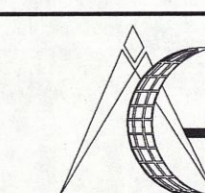
REFINED METALS CORPORATION CORRECTIVE MEASURES STUDY WORK PLAN

PROPOSED SEDIMENT SAMPLING LOCATIONS

DRAWING:

2-5

Date:	
Scale:	1"=100'
Drawn By:	P.S.G.
Checked By:	J.S.W.
Project Mgr:	J.S.W.
Project No.:	2003-1046-04
Dwg No.:	20031046-2-5
Issued:	APR 21 2003



Advanced GeoServices Corp.
Chadds Ford Business Campus, Rts. 202 & 1
Brandywine One, Suite 202
Chadds Ford, Pennsylvania 19317

